SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

PUBLISHED AT
229 BROADWAY, NEW YORK.
P. O. Box 3838.

SATURDAY, SEPTEMBER 25, 1880.

AN article in the *North American Review*, over the signature of Edison, confirms our editorial remarks, made on the 10th of July last, respecting the true condition of his system of electric illumination.

The course of Edison has been consistent, and from first to last he has emphatically stated that the results arrived at last January practically demonstrated the success of his system for the ends in view, and that nothing remained to be done but to improve his lamp and generator, to bring both to as near a state of perfection as a long series of exhaustive experiments would permit.

Of course, Edison has also had to master the enormous mass of details incident to the practical working of his electric lamp on a large scale for general use, and that he has accomplished both tasks within a year must be a matter of astonishment to all who have any conception of the work done; but Edison seems born to overcome difficulties that appall other men, and the fertility of his mental resources appears unbounded.

In the discussion of scientific questions affecting vested interests, impartial treatment and justice to the innovator are lost sight of. Better things, however, might have been expected from some of those who have misled the public in regard to this matter. Under the belief that Edison's electric lamp was a failure, thousands of dollars have been lost by those who have invested their money in electric light companies which have tried to force systems of lighting, fundamentally wrong in principle, and ridiculously unfit for general illuminating purposes.

There is one fact which places the sincerity of Edison above reproach; he has left the merit of his system of electrical illumination to assert its own supremacy with the public, and has neither paraded his light in great cities, nor gone on a lecturing tour, as other eminent inventors have done; and lastly, he has spent thousands upon thousands of dollars in perfecting his system.

On his system of electric illumination Edison has staked his time, money, and reputation. He now states that he has succeeded. Let those who are wise accept the situation.

—We see by a notice in a recent number of the *Veterinary Gazette* that a French palæontologist has discovered the osseous remains of an extinct species of horse at one of the "palæolithic stations" in his country. The species resembled our recent horse more closely than any other fossil species, but the remarkable feature was noted that the so-called "splint bones" (the lateral metacarpals) are separate and distinct from the great metacarpal or "canon bone," while in the modern horse these are co-ossified for the greater part of the length of the former. It thus constitutes a connecting link between the Hipparion and Equis genera. The number of fossil remnants discovered indicated that over a hundred thousand animals had perished in that locality, and the explanation given for this accumulation is that a large herd of animals, seized with that panic that horse-herds are liable to, rushed over a precipice and were thus killed *en masse*. A fuller account is promised in *Kosmos*, the journal from which the notice is taken, and we will refer to it in due time more fully.

There appears to be an uneasy feeling in certain English scientific circles; the complaint is openly made that the recognition of science (when compared with that received from society by the liberal arts) is inadequate, and calls for an immediate remedy. Contributions, to be levied from the State, and distinctions to be conferred by Government or the Crown, are suggested, and one writer proposes that new life peerages should be conferred on eminent scientific men, the titles being endowed with the salary of a junior lord, which, we believe is about five or ten thousand dollars a year; the selection in some cases to be made from the holders of certain offices, such as the Master of the Mint, the Astronomer Royal, or the Presidents of the Royal Society and British Association.

THE AUGUST PERSEIDS, 1880.

BY EDWIN F. SAWYER.

The annual display of August meteors occurring during the first half of the month, with a strong maximum on the 9th and 10th, has been watched for this year with the usual attention of meteor observers, and a successful series of observations have been obtained.

Although little important information has been added to our present knowledge of this well-known meteor stream, yet its fluctuating intensity from year to year is an important element to record.

The results of the observations so far as heard from indicate that the display as observed this year exceeded but slightly in intensity the shower as recorded last year, when, instead of a maximum display as anticipated being observed, the shower proved to be a very meagre one, in fact, representing a minimum phase of its return. Thus the existence of an eight-year period for this shower, as suspected and pointed out by Dr. Phipson,* appears to lack confirmation.

*See his work entitled "Meteors, Aerolites and Falling Stars," page 159.

SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

PUBLISHED AT

229 BROADWAY, NEW YORK.

P. O. Box 3838.

SATURDAY, SEPTEMBER 25, 1880.

AN article in the *North American Review*, over the signature of Edison, confirms our editorial remarks, made on the 10th of July last, respecting the true condition of his system of electric illumination.

The course of Edison has been consistent, and from first to last he has emphatically stated that the results arrived at last January practically demonstrated the success of his system for the ends in view, and that nothing remained to be done but to improve his lamp and generator, to bring both to as near a state of perfection as a long series of exhaustive experiments would permit.

Of course, Edison has also had to master the enormous mass of details incident to the practical working of his electric lamp on a large scale for general use, and that he has accomplished both tasks within a year must be a matter of astonishment to all who have any conception of the work done; but Edison seems born to overcome difficulties that appall other men, and the fertility of his mental resources appears unbounded.

In the discussion of scientific questions affecting vested interests, impartial treatment and justice to the innovator are lost sight of. Better things, however, might have been expected from some of those who have misled the public in regard to this matter. Under the belief that Edison's electric lamp was a failure, thousands of dollars have been lost by those who have invested their money in electric light companies which have tried to force systems of lighting, fundamentally wrong in principle, and ridiculously unfit for general illuminating purposes.

There is one fact which places the sincerity of Edison above reproach; he has left the merit of his system of electrical illumination to assert its own supremacy with the public, and has neither paraded his light in great cities, nor gone on a lecturing tour, as other eminent inventors have done; and lastly, he has spent thousands upon thousands of dollars in perfecting his system.

On his system of electric illumination Edison has staked his time, money, and reputation. He now states that he has succeeded. Let those who are wise accept the situation.

—We see by a notice in a recent number of the *Veterinary Gazette* that a French palæontologist has discovered the osseous remains of an extinct species of horse at one of the "palæolithic stations" in his country. The species resembled our recent horse more closely than any other fossil species, but the remarkable feature was noted that the so-called "splint bones" (the lateral metacarpals) are separate and distinct from the great metacarpal or "canon bone," while in the modern horse these are co-ossified for the greater part of the length of the former. It thus constitutes a connecting link between the Hipparion and Equis genera. The number of fossil remnants discovered indicated that over a hundred thousand animals had perished in that locality, and the explanation given for this accumulation is that a large herd of animals, seized with that panic that horse-herds are liable to, rushed over a precipice and were thus killed *en masse*. A fuller account is promised in *Kosmos*, the journal from which the notice is taken, and we will refer to it in due time more fully.

There appears to be an uneasy feeling in certain English scientific circles; the complaint is openly made that the recognition of science (when compared with that received from society by the liberal arts) is inadequate, and calls for an immediate remedy. Contributions, to be levied from the State, and distinctions to be conferred by Government or the Crown, are suggested, and one writer proposes that new life peerages should be conferred on eminent scientific men, the titles being endowed with the salary of a junior lord, which, we believe is about five or ten thousand dollars a year; the selection in some cases to be made from the holders of certain offices, such as the Master of the Mint, the Astronomer Royal, or the Presidents of the Royal Society and British Association.

THE AUGUST PERSEIDS, 1880.

By EDWIN F. SAWYER.

The annual display of August meteors occurring during the first half of the month, with a strong maximum on the 9th and 10th, has been watched for this year with the usual attention of meteor observers, and a successful series of observations have been obtained.

Although little important information has been added to our present knowledge of this well-known meteor stream, yet its fluctuating intensity from year to year is an important element to record.

The results of the observations so far as heard from indicate that the display as observed this year exceeded but slightly in intensity the shower as recorded last year, when, instead of a maximum display as anticipated being observed, the shower proved to be a very meagre one, in fact, representing a minimum phase of its return. Thus the existence of an eight-year period for this shower, as suspected and pointed out by Dr. Phipson,* appears to lack confirmation.

*See his work entitled "Meteors, Aerolites and Falling Stars," page 159.

The shower was observed by the writer this year on the evenings of the 8th and 9th (the sky being unfortunately overcast on the 10th and 11th), and the display found to be a feeble one.

A three-hours' watch on the 8th, from 9 to 12h., revealed 37 meteors. Of these, 16 were Perseids, giving as an hourly rate of Perseids (allowing for time spent in registering such tracks as were well observed) 6, and for all meteors 14.

The following table shows the number of meteors recorded each hour on the 8th during the watch, and also the calculated horary number for one observer looking towards the East:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Calculated Horary No.		State of Sky.
From	To				All Meteors.	Perseids.	
h. m.	h. m.	h.					
9 0	10 0	1	9	6	10	7	Very
10 0	11 0	1	11	3	13	4	Clear.
11 0	12 0	1	17	7	20	8	
9	12h.	3h.	37	16	14	6	

The magnitude of those recorded were as follows:

	= ♃	> 1 Mag.*	= 1 Mag.	= 2 Mag.	= 3 Mag.	= 4 and fainter.		Total.
Perseids....	1	1	3	6	2	3	=	16
Others.....	0	0	2	4	6	9	=	21
Total.....	1	1	5	10	8	12	=	37

The radiant point of the Perseids was deduced as at R. A. 38°+56°. Two showers in Cepheus furnished the majority of the uncorformable meteors recorded, their deduced positions being at R. A. 5°+75° and R. A, 332°+60°. The evening of the 9th was generally clear (a few clouds at times but slightly interfering with the observations), and a watch of four hours, from 9 to 13h., was sustained, 91 meteors being recorded. Of these, 54 or 59.4 per cent. were Perseids, 12 or 13 per cent. Cassiopeids, and 25 or 27.3 per cent. belonged to feebler showers in Andromeda, etc.

The number recorded each half hour, and the calculated horary number, were as follows:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Cassiopeids.	Calculated Horary No.		State of Sky.
From	To					All Meteors.	Perseids.	
h. m.	h. m.	m.						
9 0	9 30	30	9	5	2	22	12	Clear.
9 30	10 0	"	10	8	0	24	19	"
10 0	10 30	"	10	6	3	25	14	FewCl'ds.
10 30	11 0	"	11	7	2	26	16	Clear.
11 0	11 30	"	14	10	2	35	23	FewCl'ds.
11 30	12 0	"	15	7	2	37	16	"
12 0	12 30	"	11	5	1	26	12	Clear.
12 30	13 0	"	11	6	0	26	14	"
9	13h.	4h.	91	54	12	28	16	

Meteors thus appeared thickest between 11 and 12h., when the hourly rate for all meteors was about 36, and of Perseids 20. The shower in Cassiopeia appears of considerable intensity, and probably the confounding of these meteors (Cassiopeids) with the true Perseids (the two radiants lying approximately near one another) may account for the large hourly rate of meteors being recorded as belonging to the Perseids by ordinary and occasional observers not discriminating enough, or who are not aware that two distinct showers exist in this region of the sky. The magnitude of those recorded on the 9th were as follows:

	= ♃ or ♀	> 1 Mag.*	= 1 Mag.	= 2 Mag.	= 3 Mag.	= 4 and fainter.		Total.
Perseids....	4	5	8	13	9	15	=	54
Others.....	1	0	4	2	7	23	=	37
Total....	5	5	12	15	16	38	=	91

The radiant point of the main Perseid stream was very accurately deduced from several very short tracks near the focus, and from one perfectly stationary meteor of the 1st mag., visible two seconds and very exactly noted, as at R. A. 44¾°+56¼°. A secondary Perseid radiant was reduced from a few short tracks, and one very nearly stationary meteor, as at R. A. 55°+57°. Among the bright meteors recorded was one at 12h. 55m., which equalled ♀ (Venus) in brightness, and was of a blue color, with path from R. A. 260°+67½° to 212°+66°. This meteor came from the direction of Cygnus. A letter received from Mr. W. F. Denning, F. R. A. S., of Bristol, England, informs the writer that the shower was well observed in England. Mr. Denning at Bristol recorded from August 6 to 13, inclusive, 419 † during a period of 16½h. watching, and of these 240 were Perseids. He found the hourly rate of all meteors on the 9th to be 44, and of Perseids 28. On the 10th (when it was foggy) 34 and 28, respectively. The radiant point appeared to shift in R. A. (increasing) every night, for while on August 6 it was at R. A. 38°+56° and August 7–8 at R. A. 41°+55°, it was at R. A. 48°+57° on August 11–12, and at R. A. 49½°+57½° on August 13th. The meteors were also successfully observed at the Royal Observatory, Greenwich, where the greatest hourly number on the 10th was determined to be about 25, and also by Major Tupman, Mr. Corder, and other prominent observers.

CAMBRIDGEPORT, Sept. 12, 1880.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1880.

(Continuation of papers read.)

NOTES ON JAPANESE PULMONIFERA.

BY PROF. EDW. S. MORSE.

In this communicetion Mr. Morse called attention to the occurrence of a number of species of land snails in Yeso, identical with forms occurring in New England.

He also showed the occurrence of two species of slugs in Japan, which are also common in New England.

While he had met with most of the fresh water genera of Pulmonifera in Japan, he had never yet found an example of *Physa*.

PROBLEMS IN WATSON'S CO-ORDINATES.

BY THOMAS HILL, D.D., LL.D.

IN this paper Dr. Hill investigates the equation $p=A(a-bSin.\ m\nu)^n$; giving his principal attention to the case in which $b=m=1$, and $n=-1$, which represents a curve like a figure 8 with its top concave, somewhat like the sign for Taurus. When $a=0$, this becomes a parabola; and when $a>2$, an

The shower was observed by the writer this year on the evenings of the 8th and 9th (the sky being unfortunately overcast on the 10th and 11th), and the display found to be a feeble one.

A three-hours' watch on the 8th, from 9 to 12h., revealed 37 meteors. Of these, 16 were Perseids, giving as an hourly rate of Perseids (allowing for time spent in registering such tracks as were well observed) 6, and for all meteors 14.

The following table shows the number of meteors recorded each hour on the 8th during the watch, and also the calculated horary number for one observer looking towards the East:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Calculated Horary No.		State of Sky.
From	To				All Meteors.	Perseids.	
h. m.	h. m.	h.					
9 0	10 0	1	9	6	10	7	Very Clear.
10 0	11 0	1	11	3	13	4	
11 0	12 0	1	17	7	20	8	
9	12h.	3h.	37	16	14	6	

The magnitude of those recorded were as follows:

	=♃	>1Mag.*	=1Mag.	=2Mag.	=3Mag.	=4 and fainter.		Total.
Perseids...	1	1	3	6	2	3	=	16
Others	0	0	2	4	6	9	=	21
Total....	1	1	5	10	8	12	=	37

The radiant point of the Perseids was deduced as at R. A. 38°+56°. Two showers in Cepheus furnished the majority of the uncorformable meteors recorded, their deduced positions being at R. A. 5°+75° and R. A, 332°+60°. The evening of the 9th was generally clear (a few clouds at times but slightly interfering with the observations), and a watch of four hours, from 9 to 13h., was sustained, 91 meteors being recorded. Of these, 54 or 59.4 per cent. were Perseids, 12 or 13 per cent. Cassiopeids, and 25 or 27.3 per cent. belonged to feebler showers in Andromeda, etc.

The number recorded each half hour, and the calculated horary number, were as follows:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Cassiopeids.	Calculated Horary No.		State of Sky.
From	To					All Meteors.	Perseids.	
h. m.	h. m.	m.						
9 0	9 30	30	9	5	2	22	12	Clear.
9 30	10 0	"	10	8	0	24	19	"
10 0	10 30	"	10	6	3	25	14	FewCl'ds.
10 30	11 0	"	11	7	2	26	16	Clear.
11 0	11 30	"	14	10	2	35	23	FewCl'ds.
11 30	12 0	"	15	7	2	37	16	"
12 0	12 30	"	11	5	1	26	12	Clear.
12 30	13 0	"	11	6	0	26	14	"
9	13h.	4h.	91	54	12	28	16	

Meteors thus appeared thickest between 11 and 12h., when the hourly rate for all meteors was about 36, and of Perseids 20. The shower in Cassiopeia appears of considerable intensity, and probably the confounding of these meteors (Cassiopeids) with the true Perseids (the two radiants lying approximately near one another) may account for the large hourly rate of meteors being recorded as belonging to the Perseids by ordinary and occasional observers not discriminating enough, or who are not aware that two distinct showers exist in this region of the sky. The magnitude of those recorded on the 9th were as follows:

	=♃ or ♀	>1Mag.*	=1Mag.	=2Mag.	=3Mag.	=4 and fainter.		Total.
Perseids...	4	5	8	13	9	15	=	54
Others	1	0	4	2	7	23	=	37
Total ...	5	5	12	15	16	38	=	91

The radiant point of the main Perseid stream was very accurately deduced from several very short tracks near the focus, and from one perfectly stationary meteor of the 1st mag., visible two seconds and very exactly noted, as at R. A. 44¾°+56¼°. A secondary Perseid radiant was reduced from a few short tracks, and one very nearly stationary meteor, as at R. A. 55°+57°. Among the bright meteors recorded was one at 12h. 55m., which equalled ♀ (Venus) in brightness, and was of a blue color, with path from R. A. 260°+67½° to 212°+66°. This meteor came from the direction of Cygnus. A letter received from Mr. W. F. Denning, F. R. A. S., of Bristol, England, informs the writer that the shower was well observed in England. Mr. Denning at Bristol recorded from August 6 to 13, inclusive, 419 ↧ during a period of 16½h. watching, and of these 240 were Perseids. He found the hourly rate of all meteors on the 9th to be 44, and of Perseids 28. On the 10th (when it was foggy) 34 and 28, respectively. The radiant point appeared to shift in R. A. (increasing) every night, for while on August 6 it was at R. A. 38°+56° and August 7–8 at R. A. 41°+55°, it was at R. A. 48°+57° on August 11–12, and at R. A. 49½°+57½° on August 13th. The meteors were also successfully observed at the Royal Observatory, Greenwich, where the greatest hourly number on the 10th was determined to be about 25, and also by Major Tupman, Mr. Corder, and other prominent observers.

CAMBRIDGEPORT, Sept. 12, 1880.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1880.

(Continuation of papers read.)

NOTES ON JAPANESE PULMONIFERA.

By PROF. EDW. S. MORSE.

In this communicetion Mr. Morse called attention to the occurrence of a number of species of land snails in Yeso, identical with forms occurring in New England.

He also showed the occurrence of two species of slugs in Japan, which are also common in New England.

While he had met with most of the fresh water genera of Pulmonifera in Japan, he had never yet found an example of *Physa*.

PROBLEMS IN WATSON'S CO-ORDINATES.

By THOMAS HILL, D.D., LL.D.

IN this paper Dr. Hill investigates the equation $p=A(a-b\sin. m\nu)^n$; giving his principal attention to the case in which $b=m=1$, and $n=-1$, which represents a curve like a figure 8 with its top concave, somewhat like the sign for Taurus. When $a=0$, this becomes a parabola; and when $a>2$, an

The shower was observed by the writer this year on the evenings of the 8th and 9th (the sky being unfortunately overcast on the 10th and 11th), and the display found to be a feeble one.

A three-hours' watch on the 8th, from 9 to 12h., revealed 37 meteors. Of these, 16 were Perseids, giving as an hourly rate of Perseids (allowing for time spent in registering such tracks as were well observed) 6, and for all meteors 14.

The following table shows the number of meteors recorded each hour on the 8th during the watch, and also the calculated horary number for one observer looking towards the East:

Duration of Watch. From	Duration of Watch. To	Length of Watch.	No. of Meteors seen.	Perseids.	Calculated Horary No. All Meteors.	Calculated Horary No. Perseids.	State of Sky.
h. m.	h. m.	h.					
9 0	10 0	1	9	6	10	7	Very Clear.
10 0	11 0	1	11	3	13	4	
11 0	12 0	1	17	7	20	8	
9	12h.	3h.	37	16	14	6	

The magnitude of those recorded were as follows:

	=♃	>1Mag.*	=1Mag.	=2Mag.	=3Mag.	=4 and fainter.		Total.
Perseids	1	1	3	6	2	3	=	16
Others	0	0	2	4	6	9	=	21
Total	1	1	5	10	8	12	=	37

The radiant point of the Perseids was deduced as at R. A. 38°+56°. Two showers in Cepheus furnished the majority of the uncorformable meteors recorded, their deduced positions being at R. A. 5°+75° and R. A, 332°+60°. The evening of the 9th was generally clear (a few clouds at times but slightly interfering with the observations), and a watch of four hours, from 9 to 13h., was sustained, 91 meteors being recorded. Of these, 54 or 59.4 per cent. were Perseids, 12 or 13 per cent. Cassiopeids, and 25 or 27.3 per cent. belonged to feebler showers in Andromeda, etc.

The number recorded each half hour, and the calculated horary number, were as follows:

Duration of Watch. From	Duration of Watch. To	Length of Watch.	No. of Meteors seen.	Perseids.	Cassiopeids.	Calculated Horary No. All Meteors.	Calculated Horary No. Perseids.	State of Sky.
h. m.	h. m.	m.						
9 0	9 30	30	9	5	2	22	12	Clear.
9 30	10 0	"	10	8	0	24	19	"
10 0	10 30	"	10	6	3	25	14	FewCl'ds.
10 30	11 0	"	11	7	2	26	16	Clear.
11 0	11 30	"	14	10	2	35	23	FewCl'ds.
11 30	12 0	"	15	7	2	37	16	"
12 0	12 30	"	11	5	1	26	12	Clear.
12 30	13 0	"	11	6	0	26	14	"
9	13h.	4h.	91	54	12	28	16	

Meteors thus appeared thickest between 11 and 12h., when the hourly rate for all meteors was about 36, and of Perseids 20. The shower in Cassiopeia appears of considerable intensity, and probably the confounding of these meteors (Cassiopeids) with the true Perseids (the two radiants lying approximately near one another) may account for the large hourly rate of meteors being recorded as belonging to the Perseids by ordinary and occasional observers not discriminating enough, or who are not aware that two distinct showers exist in this region of the sky. The magnitude of those recorded on the 9th were as follows:

	=♃ or ♀	>1Mag.*	=1Mag.	=2Mag.	=3Mag.	=4 and fainter.		Total.
Perseids	4	5	8	13	9	15	=	54
Others	1	0	4	2	7	23	=	37
Total	5	5	12	15	16	38	=	91

The radiant point of the main Perseid stream was very accurately deduced from several very short tracks near the focus, and from one perfectly stationary meteor of the 1st mag., visible two seconds and very exactly noted, as at R. A. 44¾°+56¼°. A secondary Perseid radiant was reduced from a few short tracks, and one very nearly stationary meteor, as at R. A. 55°+57°. Among the bright meteors recorded was one at 12h. 55m., which equalled ♀ (Venus) in brightness, and was of a blue color, with path from R. A. 260°+67½° to 212°+66°. This meteor came from the direction of Cygnus. A letter received from Mr. W. F. Denning, F. R. A. S., of Bristol, England, informs the writer that the shower was well observed in England. Mr. Denning at Bristol recorded from August 6 to 13, inclusive, 419 ✝ during a period of 16½h. watching, and of these 240 were Perseids. He found the hourly rate of all meteors on the 9th to be 44, and of Perseids 28. On the 10th (when it was foggy) 34 and 28, respectively. The radiant point appeared to shift in R. A. (increasing) every night, for while on August 6 it was at R. A. 38°+56° and August 7–8 at R. A. 41°+55°, it was at R. A. 48°+57° on August 11–12, and at R. A. 49½°+57½° on August 13th. The meteors were also successfully observed at the Royal Observatory, Greenwich, where the greatest hourly number on the 10th was determined to be about 25, and also by Major Tupman, Mr. Corder, and other prominent observers.

CAMBRIDGEPORT, Sept. 12, 1880.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1880.

(Continuation of papers read.)

NOTES ON JAPANESE PULMONIFERA.

BY PROF. EDW. S. MORSE.

In this communicetion Mr. Morse called attention to the occurrence of a number of species of land snails in Yeso, identical with forms occurring in New England.

He also showed the occurrence of two species of slugs in Japan, which are also common in New England.

While he had met with most of the fresh water genera of Pulmonifera in Japan, he had never yet found an example of *Physa*.

PROBLEMS IN WATSON'S CO-ORDINATES.

BY THOMAS HILL, D.D., LL.D.

IN this paper Dr. Hill investigates the equation $p=A(a—bSin.\ m\nu)^n$; giving his principal attention to the case in which $b=m=1$, and $n=—1$, which represents a curve like a figure 8 with its top concave, somewhat like the sign for Taurus. When $a=0$, this becomes a parabola; and when $a>2$, an

oval, not an ellipse; a new illustration, in Dr. Hill's opinion, of the fact that the ability of members of two groups of forms to assume an intermediate form affords but a very slight presumption, if any, for a community of origin in the group.

FRICTION OF LUBRICATING OILS.

By C. J. H. Woodbury.

The resistance existing between bodies of fixed matter moving with different velocities or directions presents itself in the form of a passive force, which results in the diminution or destruction of opponent motion. Modern science has demonstrated that this destruction is only apparent, being merely the conversion of the force of the moving body into the oscillation of the resisting obstacle or into that molecular vibration which is recognized as heat. Direct friction refers to the case where the two bodies are in actual contact and mediate friction where a film of lubricant is interposed between the surfaces, and it is this which applies to nearly every motion in mechanics where bodies slide upon each other. The coefficient of friction is the relation which the pressure upon moving surfaces bears to resistance. Mr. Woodbury limited his discussion to a description of the apparatus for measuring the friction of lubricating oils, the method of its use and the results obtained with a number of oils in the market which are used for lubricating spindles. Previous investigation of nine different oil-testing machines used showed that none of them could yield consistent duplicate results in furnishing the co-efficient of friction. The paper mentioned the circumstances which must be known or preserved constant,—temperature, velocity, pressure, area of frictional surfaces, thickness of the film of oil between the surfaces, and the mechanical effect of the friction. The radiation of heat generated by friction must be reduced to a minimum, and no oil should be allowed to escape till subjected to attrition. Therefore a dynamometer is required which is instantaneous and automatic in its action. Mr. Woodbury described in detail the construction of his instrument and the mode of its operation, which was too elaborate to be reproduced in an abstract. The operation of the machine under equal conditions with the same oil gives results which are as closely consistent with each other as could be expected from such physical measurements. Much of the slight irregularity was due to the variable speed of the engine. The results were remarkably uniform, but they do not agree with the laws of friction, as given in works on mechanics, but the co-efficient of friction varies in an inverse ratio with the pressure. Friction varies as the area, because the adhesiveness of the lubricant is proportional to the area, and the resistance due to this cause is a larger fraction of the total mechanical effect with light than with heavy pressures. The lubricant used is one of the most important factors in the cost of power. In the present condition of engineering science it is impossible to state what exact proportion of the power used by a mill is lost in sliding friction, but in a print-cloth mill only about 25 per cent. of the power is utilized in the actual processes of carding, spinning and weaving the fibre, not including the machinery engaged in the operation, leaving 75 per cent. of the power as absorbed by the rigidity of the belts, the resistance of the air and friction. Mr. Woodbury concludes that the successful operation of a spinning frame is far more closely dependent upon the individual management in respect to the conditions of band-tension, lubrication and temperature of the spinning room than all other causes combined. Not that some forms of spindle are not superior to others, but without wise supervision the most desirable forms of spindle must fail to show the merits due to the skill of their promoter. The lubricating qualities of an oil are inversely proportional to its viscosity; the endurance of a lubricant is, in some degree, proportional to its adhesion to the surfaces forming the journal. An ideal lubricant, in these respects, would be a fluid whose molecules had a minimum cohesion for each other, and a maximum adhesion for metallic surfaces. Viscous oils adhere more strongly to metal surfaces, hence it is obligatory to use such thick lubricants on heavy bearings. With light pressures more fluid oils are admissable, and in all cases the oils should be as limpid as possible. Oils with great endurance are likely to give great fractional resistance, and in the endeavor to save gallons of oil, many a manager has wasted tons of coal. The true solution of the problem of lubricating machinery is to ascertain the consumption of oil and the expenditure of power, both being measured by the same unit, namely, dollars. Mr. Woodbury detailed his experiments in measuring the fluidity of oils, and gave the data for determining the safety and efficiency of a lubricant.

THE LAW OF LAND-FORMING ON OUR GLOBE.

By Prof. Richard Owen, M.D., LL.D.*

The truth of a general law can best be proved by such a large collection of co-incident facts as to carry conviction to the scientist. But in a synopsis all that can be done is to state the law and suggest a few prominent demonstrations, leaving it for the reader to trace with compasses or string, on a good globe or large map of each separate continent, those phenomena presented, and such other analogous details as may suggest themselves.

General Law: *The land shows itself above the ocean level, in definite multiple proportions, by measurement; the unit is the angular difference between the axis of revolution and the axis of progression.*

For convenience, as that angle has been lessening for some centuries, we might call it $24° = \frac{360}{15}°$.

The greatest width and length of continents $= 3 \times 24° = 72° = \frac{360}{5}°$.

Consequently, the radius for continents $= 36° = \frac{360}{10}°$.

The measure for oceanic distances is the complement of $24° = 66°$.

The ratio of land to water is as 100 : 275.

The ratio of 24° to 66° :: 100 : 275.

All measurements are to be estimated at the equator.

The above general law may, for the purpose of demonstration, be subdivided.

I.—*First subdivision or section of the law.*—Many longitudinal elevations and depressions on the earth's surface, especially near the greatest median, north and south, extension of each continent, coincide with some meridian. Although this is partly due to early cooling and shrinkage, probably all continents have been extended north and south by successive depositions, as great river-deltas are usually found near the southern terminus of that median line. On these median lines we seldom find volcanoes.

Demonstration.—As the details regarding North America are most familiar, illustrations will be taken chiefly from that continent, although the law applies as well to all the others. In North America the greatest elongation is about in long. 96° W. of Gr. Near that line, as we shall see later, are found the foci of land forming for our continent, and not far distant the great rivers which drain the Mississippi valley. From Boothia Felix to the Gulf of Mexico we have no volcanoes, and the only earthquake action (near New Madrid, etc.) is due to a great circle of force crossing diagonally as shown subsequently.

II.—*Second Subdivision of the Law.*—Although the median lines of continents run north and south, the outlines or trends of continents form, with the meridians, angles of about 23½° (as I pointed out in "Key to the Geology of the

* Former State Geologist of Indiana, and for fifteen years Professor of Natural Science in the Indiana State University.

oval, not an ellipse; a new illustration, in Dr. Hill's opinion, of the fact that the ability of members of two groups of forms to assume an intermediate form affords but a very slight presumption, if any, for a community of origin in the group.

FRICTION OF LUBRICATING OILS.

BY C. J. H. WOODBURY.

The resistance existing between bodies of fixed matter moving with different velocities or directions presents itself in the form of a passive force, which results in the diminution or destruction of opponent motion. Modern science has demonstrated that this destruction is only apparent, being merely the conversion of the force of the moving body into the oscillation of the resisting obstacle or into that molecular vibration which is recognized as heat. Direct friction refers to the case where the two bodies are in actual contact and mediate friction where a film of lubricant is interposed between the surfaces, and it is this which applies to nearly every motion in mechanics where bodies slide upon each other. The coefficient of friction is the relation which the pressure upon moving surfaces bears to resistance. Mr. Woodbury limited his discussion to a description of the apparatus for measuring the friction of lubricating oils, the method of its use and the results obtained with a number of oils in the market which are used for lubricating spindles. Previous investigation of nine different oil-testing machines used showed that none of them could yield consistent duplicate results in furnishing the co-efficient of friction. The paper mentioned the circumstances which must be known or preserved constant,—temperature, velocity, pressure, area of frictional surfaces, thickness of the film of oil between the surfaces, and the mechanical effect of the friction. The radiation of heat generated by friction must be reduced to a minimum, and no oil should be allowed to escape till subjected to attrition. Therefore a dynamometer is required which is instantaneous and automatic in its action. Mr. Woodbury described in detail the construction of his instrument and the mode of its operation, which was too elaborate to be reproduced in an abstract. The operation of the machine under equal conditions with the same oil gives results which are as closely consistent with each other as could be expected from such physical measurements. Much of the slight irregularity was due to the variable speed of the engine. The results were remarkably uniform, but they do not agree with the laws of friction, as given in works on mechanics, but the co-efficient of friction varies in an inverse ratio with the pressure. Friction varies as the area, because the adhesiveness of the lubricant is proportional to the area, and the resistance due to this cause is a larger fraction of the total mechanical effect with light than with heavy pressures. The lubricant used is one of the most important factors in the cost of power. In the present condition of engineering science it is impossible to state what exact proportion of the power used by a mill is lost in sliding friction, but in a print-cloth mill only about 25 per cent. of the power is utilized in the actual processes of carding, spinning and weaving the fibre, not including the machinery engaged in the operation, leaving 75 per cent. of the power as absorbed by the rigidity of the belts, the resistance of the air and friction. Mr. Woodbury concludes that the successful operation of a spinning frame is far more closely dependent upon the individual management in respect to the conditions of band-tension, lubrication and temperature of the spinning room than all other causes combined. Not that some forms of spindle are not superior to others, but without wise supervision the most desirable forms of spindle must fail to show the merits due to the skill of their promoter. The lubricating qualities of an oil are inversely proportional to its viscosity; the endurance of a lubricant is, in some degree, proportional to its adhesion to the surfaces forming the journal. An ideal lubricant, in these respects, would be a fluid whose molecules had a minimum cohesion for each other, and a maximum adhesion for metallic surfaces. Viscous oils adhere more strongly to metal surfaces, hence it is obligatory to use such thick lubricants on heavy bearings. With light pressures more fluid oils are admissable, and in all cases the oils should be as limpid as possible. Oils with great endurance are likely to give great fractional resistance, and in the endeavor to save gallons of oil, many a manager has wasted tons of coal. The true solution of the problem of lubricating machinery is to ascertain the consumption of oil and the expenditure of power, both being measured by the same unit, namely, dollars. Mr. Woodbury detailed his experiments in measuring the fluidity of oils, and gave the data for determining the safety and efficiency of a lubricant.

THE LAW OF LAND-FORMING ON OUR GLOBE.

BY PROF. RICHARD OWEN, M.D., LL.D.*

THE truth of a general law can best be proved by such a large collection of co-incident facts as to carry conviction to the scientist. But in a synopsis all that can be done is to state the law and suggest a few prominent demonstrations, leaving it for the reader to trace with compasses or string, on a good globe or large map of each separate continent, those phenomena presented, and such other analogous details as may suggest themselves.

GENERAL LAW: *The land shows itself above the ocean level, in definite multiple proportions, by measurement; the unit is the angular difference between the axis of revolution and the axis of progression.*

For convenience, as that angle has been lessening for some centuries, we might call it $24° = \frac{360}{15}°$.

The greatest width and length of continents $= 3 \times 24° = 72° = \frac{360}{5}°$.

Consequently, the radius for continents $= 36° = \frac{360}{10}°$.

The measure for oceanic distances is the complement of $24° = 66°$.

The ratio of land to water is as 100 : 275.

The ratio of 24° to 66° :: 100 : 275.

All measurements are to be estimated at the equator.

The above general law may, for the purpose of demonstration, be subdivided.

I.—*First subdivision or section of the law.*—Many longitudinal elevations and depressions on the earth's surface, especially near the greatest median, north and south, extension of each continent, coincide with some meridian. Although this is partly due to early cooling and shrinkage, probably all continents have been extended north and south by successive depositions, as great river-deltas are usually found near the southern terminus of that median line. On these median lines we seldom find volcanoes.

Demonstration.—As the details regarding North America are most familiar, illustrations will be taken chiefly from that continent, although the law applies as well to all the others. In North America the greatest elongation is about in long. 96° W. of Gr. Near that line, as we shall see later, are found the foci of land forming for our continent, and not far distant the great rivers which drain the Mississippi valley. From Boothia Felix to the Gulf of Mexico we have no volcanoes, and the only earthquake action (near New Madrid, etc.) is due to a great circle of force crossing diagonally as shown subsequently.

II.—*Second Subdivision of the Law.*—Although the median lines of continents run north and south, the outlines or trends of continents form, with the meridians, angles of about 23½° (as I pointed out in "Key to the Geology of the

* Former State Geologist of Indiana, and for fifteen years Professor of Natural Science in the Indiana State University.

oval, not an ellipse; a new illustration, in Dr. Hill's opinion, of the fact that the ability of members of two groups of forms to assume an intermediate form affords but a very slight presumption, if any, for a community of origin in the group.

FRICTION OF LUBRICATING OILS.

BY C. J. H. WOODBURY.

The resistance existing between bodies of fixed matter moving with different velocities or directions presents itself in the form of a passive force, which results in the diminution or destruction of opponent motion. Modern science has demonstrated that this destruction is only apparent, being merely the conversion of the force of the moving body into the oscillation of the resisting obstacle or into that molecular vibration which is recognized as heat. Direct friction refers to the case where the two bodies are in actual contact and mediate friction where a film of lubricant is interposed between the surfaces, and it is this which applies to nearly every motion in mechanics where bodies slide upon each other. The coefficient of friction is the relation which the pressure upon moving surfaces bears to resistance. Mr. Woodbury limited his discussion to a description of the apparatus for measuring the friction of lubricating oils, the method of its use and the results obtained with a number of oils in the market which are used for lubricating spindles. Previous investigation of nine different oil-testing machines used showed that none of them could yield consistent duplicate results in furnishing the co-efficient of friction. The paper mentioned the circumstances which must be known or preserved constant,—temperature, velocity, pressure, area of frictional surfaces, thickness of the film of oil between the surfaces, and the mechanical effect of the friction. The radiation of heat generated by friction must be reduced to a minimum, and no oil should be allowed to escape till subjected to attrition. Therefore a dynamometer is required which is instantaneous and automatic in its action. Mr. Woodbury described in detail the construction of his instrument and the mode of its operation, which was too elaborate to be reproduced in an abstract. The operation of the machine under equal conditions with the same oil gives results which are as closely consistent with each other as could be expected from such physical measurements. Much of the slight irregularity was due to the variable speed of the engine. The results were remarkably uniform, but they do not agree with the laws of friction, as given in works on mechanics, but the co-efficient of friction varies in an inverse ratio with the pressure. Friction varies as the area, because the adhesiveness of the lubricant is proportional to the area, and the resistance due to this cause is a larger fraction of the total mechanical effect with light than with heavy pressures. The lubricant used is one of the most important factors in the cost of power. In the present condition of engineering science it is impossible to state what exact proportion of the power used by a mill is lost in sliding friction, but in a print-cloth mill only about 25 per cent. of the power is utilized in the actual processes of carding, spinning and weaving the fibre, not including the machinery engaged in the operation, leaving 75 per cent. of the power as absorbed by the rigidity of the belts, the resistance of the air and friction. Mr. Woodbury concludes that the successful operation of a spinning frame is far more closely dependent upon the individual management in respect to the conditions of band-tension, lubrication and temperature of the spinning room than all other causes combined. Not that some forms of spindle are not superior to others, but without wise supervision the most desirable forms of spindle must fail to show the merits due to the skill of their promoter. The lubricating qualities of an oil are inversely proportional to its viscosity; the endurance of a lubricant is, in some degree, proportional to its adhesion to the surfaces forming the journal. An ideal lubricant, in these respects, would be a fluid whose molecules had a minimum cohesion for each other, and a maximum adhesion for metallic surfaces. Viscous oils adhere more strongly to metal surfaces, hence it is obligatory to use such thick lubricants on heavy bearings. With light pressures more fluid oils are admissable, and in all cases the oils should be as limpid as possible. Oils with great endurance are likely to give great fractional resistance, and in the endeavor to save gallons of oil, many a manager has wasted tons of coal. The true solution of the problem of lubricating machinery is to ascertain the consumption of oil and the expenditure of power, both being measured by the same unit, namely, dollars. Mr. Woodbury detailed his experiments in measuring the fluidity of oils, and gave the data for determining the safety and efficiency of a lubricant.

THE LAW OF LAND-FORMING ON OUR GLOBE.

By PROF. RICHARD OWEN, M.D., LL.D.*

THE truth of a general law can best be proved by such a large collection of co-incident facts as to carry conviction to the scientist. But in a synopsis all that can be done is to state the law and suggest a few prominent demonstrations, leaving it for the reader to trace with compasses or string, on a good globe or large map of each separate continent, those phenomena presented, and such other analogous details as may suggest themselves.

GENERAL LAW: *The land shows itself above the ocean level, in definite multiple proportions, by measurement; the unit is the angular difference between the axis of revolution and the axis of progression.*

For convenience, as that angle has been lessening for some centuries, we might call it $24° = \frac{360}{15}°$.

The greatest width and length of continents $= 3 \times 24° = 72° = \frac{360}{5}°$.

Consequently, the radius for continents $= 36° = \frac{360}{10}°$.

The measure for oceanic distances is the complement of $24° = 66°$.

The ratio of land to water is as 100 : 275.

The ratio of 24° to 66° :: 100 : 275.

All measurements are to be estimated at the equator.

The above general law may, for the purpose of demonstration, be subdivided.

I.—*First subdivision or section of the law.*—Many longitudinal elevations and depressions on the earth's surface, especially near the greatest median, north and south, extension of each continent, coincide with some meridian. Although this is partly due to early cooling and shrinkage, probably all continents have been extended north and south by successive depositions, as great river-deltas are usually found near the southern terminus of that median line. On these median lines we seldom find volcanoes.

Demonstration.—As the details regarding North America are most familiar, illustrations will be taken chiefly from that continent, although the law applies as well to all the others. In North America the greatest elongation is about in long. 96° W. of Gr. Near that line, as we shall see later, are found the foci of land forming for our continent, and not far distant the great rivers which drain the Mississippi valley. From Boothia Felix to the Gulf of Mexico we have no volcanoes, and the only earthquake action (near New Madrid, etc.) is due to a great circle of force crossing diagonally as shown subsequently.

II.—*Second Subdivision of the Law.*—Although the median lines of continents run north and south, the outlines or trends of continents form, with the meridians, angles of about 23½° (as I pointed out in "Key to the Geology of the

* Former State Geologist of Indiana, and for fifteen years Professor of Natural Science in the Indiana State University.

Globe," published in 1857) and thus constitute great circles from the Arctic to the Antartic circles, along which (perhaps from the earth's crust being thinner than in the middle of continents) important seismic phenomena, such as volcanic and earthquake action are frequent and abundant.

Demonstration.—Elevating the north pole of the globe 23½°, and bringing the straits of Macassar and of Bali* to the eastern horizon, we find the wooden horizon mark the general trend of Asia from the volcanoes of Java and Celebes, passing through the volcanic regions of Japan, Kuriles, and Kamchatka, and skirting the Japan warm stream. On the opposite side of the globe this great circle passes from Alaska to the basaltic region of Lake Superior, then through South Carolina and the Bahamas to the earthquake region of Caraccas, etc., explaining the convulsion in South Carolina of 1811–12, just before the destruction of La Guayras and Caraccas. Revolving the globe from west to east 72°, or 1-5th of 360°, we bring the coast of Africa to the horizon; 72° more will give the trend of South America, passing between Madeira proper and Porto Santo, where Lyell observed a *continental* difference, especially among the mollusks, as well as the seismic force adequate to elevate the British coast (Lyell says in glacial epoch) at least 600 feet, and Scandinavia, in historic times, at some points five feet per century, total as much as 700 feet (see Lyell's "Principles," vol. I., p. 133.) On the other side ef the globe it may have furnished the dynamics of some volcanoes in Japan and Solomon's Archipelago, as well as the earthquakes of New Zealand near Cook's Straits. The trend of North America, just 72° west of the above, passes from a volcanic region between Mexico and Central America, along between the Appalachians, which it raised, and our Atlantic seaboard, nearly parallel to the Gulf Stream, and up to the Geysers and volcanoes of Iceland, coming round by the Field of Fire (Baker) on the Caspian, and through the ancient volcanic trap of Hindostan, consequently is older than the South American trend. The last or fifth trend either separated Australia from New Zealand, or more probably brought the latter up recently, as in it we find quaternary formations, such as the gigantic Dinornis.

III.—*Third subdivision of the law.*—An addition to the dynamics of land-forming is found in there being for each northern continent two foci of consolidation, which may have resulted from shrinkage causing depression of adjoining seas or seismic elevation of the plastic crust. The northern focus, when two exist, is near the continental median line and arctic circle; the other occupies the geographical centre of the continent. Concentric circles around these foci not only mark important additions to the land and orography of each continent, but especially pass as they enlarge from the areas of older geological formations to those of newer.

Demonstration.—A radius of 24° from the geographical central focus often marks the outline of the continent proper, while that of 36° embraces usually some of the adjoining islands, leaving out perhaps some peninsulas. Between these two circles we find almost exclusively cenozoic formations (tertiary), and outside of 36° in the three southern continents quaternary. The details of North American geology must suffice in an abstract, designating for the other continents simply the position of the foci. The northern focus for North America is in Boothia Felix. With a radius of 24° from that point we reach the southern point of the V shaped area near Lake Superior, as laid down by Prof. Dana at p. 149 of his "Manual," where the archæan meets the paleozoic. A more extended radius passes through the coal of northern Iowa, of Michigan, New Brunswick, and Newfoundland. A radius of about 29°–30° gives us the mesozoic of Kansas and the Triassic (a red sandstone with bird tracks) of Connecticut and Massachusetts.

Removing our center to the west shore of Lake Superior, a radius of 11° to 12° gives us Silurian (Lower and Upper) from Niagara to near Springfield, O., Lexington and Frankfort, Ky., Nashville, Tenn., dominating at least the eastern half of the circle, while the west was still under water. A radius of 12° to 13° marks the Applachian and other coal fields from north of Harrisburg, southwest through Tuscaloosa, Ala., to Arkansas and Texas. A radius of 15° is Mesozoic, curving from the Cretaceous of Utah and Colorado through that of Arkansas and Tennessee to that of New Jersey. A radius of 24° outlines the continent from Cape Breton and Cape Sable to the Golden Gates; while with from 18° to 24° we pass through the *marine* Tertiary of Nevada, California, Northern Mexico, Texas, Louisiana, Mississippi, Florida, Georgia, South and North Carolina, Maryland and New Jersey to Martha's Vineyard and Barnstable, Mass. The circle of 36° embraces Yucatan and Honduras; reaching to near Lake Nicaragua it encloses several islands near our Pacific Coast and takes in part of Alaska, as well as a portion of Greenland.

The northern focus for *Europe* is in Scandinavia, Lat. 68° N., Long. 22° E.; the geographical and later centre is in Lat. 49½° N., Long. 20° E.

The northern focus for *Asia* is in about Lat. 71° N., Long. 99° E.; the centre is in same Long., and in Lat. 51° N.

For *South America* the centre is on the Tropic of Capricorn, in about Long. 65° W.

For *Africa* the centre is at St. Thomas' Island, where the Magnetic Equator of dip crosses the terrestrial Equator.

For *Australia* the centre is on the Tropic of Capricorn, Long. 148° E.

These are approximate, and may require slight modifications.

IV.—*Fourth Subdivision of the Law.*—Besides these three modifying influences, toward the close of the Mesozoic and beginning of the Cenozoic, the Western Alps became a dynamic focus, reaching, according to Elie de Beaumont, their present height during the Miocene Period or at its close, while the eastern Alps reached their present height during the Pliocene. Mount Rosa is nearly, if not quite, the geographical centre of the entire dry land on the globe; and the Alps connect with the Himalayas and Andes of similar geological age by a great circle or belt of immense seismic activity.

Demonstration.—A radius of 9° from Mt. Rosa defines accurately the Miocene Tertiary on the east coast of England, also in the middle of Denmark; through Prussia it is Eocene, but Miocene again in Austria, Calabria, Sicily, Algiers and Central Spain. With a radius of 36° from Mt. Rosa, we describe a curve from the Miocene of the eastern flanks of the Urals to that of Spitzbergen and Greenland; contrasting this radius somewhat, we follow the Carboniferous and Peruican rocks of the Urals to Spitzbergen. The great circle pointed out as passing from the Alps to the Himalayas and Andes marks chiefly Tertiary regions.

Summary.—The dynamics of land forming would seem, from the foregoing demonstrations, to comprise first a longitudinal force, scarcely if at all seismic, adding to continents chiefly by aqueous depositions, as each northern continent, near the termination of the median line, has a large river delta. Secondly, there is an Arctic-Antartic force, mostly along continental coast lines, and connected with active seismic phenomena of elevations and depressions; apparently from these being thinner portions of the earth's crust than at continental medial elongations. Thirdly, in each continent there are radii and circles connected with one or two important foci, which have not only aided in defining the geographical limits of each continent, but also in bringing geological deposits in successive curves of increase to or near the surface; possibly because the wave impulse directly under the plastic focus sends its molten contents to equidistant circles beneath the plastic crust. Lastly, the geology of each continent has also been somewhat modified, especially in cenozoic times, by the Alpine central focus (or terminal axis from the centre) of the dry land hemisphere.

As corollaries, attention may be called to two additional great circles of activity which are secondaries to that phase

* At these straits, though only about fifteen miles across, Wallace found as great a difference between the flora and fauna as if they had been a thousand miles apart, nearly all the animals south-east of that line being marsupial, while northwest the chief type was and is carnivorous.

of the ecliptic whose longest and shortest day, for our northern hemisphere, would coincide with the north and south plane, passing through the Alpine focus and also through the node of intersection for the terrestrial and magnetic Equator. This gives us one great circle from Behring's Straits to its antipodal Antarctic, due south from Mt. Rosa; the other from Scandinavia, at the Arctic Circle, to the antipodal point on the Antarctic, which will be found due south from Behring's Straits. As these ran through the northern hemisphere, the course of one from the volcanoes of Sumatra is nearly parallel to the formerly described Asiatic continental trend as well as the Japan Gulf Stream, and nearly parallel again through North and South America to said Asiatic trend prolonged, whereby a region is inclosed of Nevada geysers, New Madrid earthquake region, Arkansas and Virginia hot springs, Cuban, Venezuelan, Grenadan, Peruvian, and Chilean volcanic and earthquake regions. The course of the other, while running nearly parallel to the North American east coast trend, is from the thirty-nine volcanoes (see Dana's Manual, p. 703) of Central America to the geyser and volcanoes of Iceland, thus inclosing between it and the North American trend our Gulf Stream, probably even aiding to heat it; while on the opposite side of the globe the inclosed line embraces the Hindoo Cush and Western Himalaya elevations; the disturbed regions of Hindostan and islands in the Bay of Bengal (some brought up within the Historical Period) as well as the numerous volcanoes of Sumatra.

The evident connection of these laws with Terrestrial Magnetism, Mining and Mineralogy, Archæology and Ethnology, is left for future discussion.

AN INVESTIGATION OF THE VIBRATIONS OF PLATES VIBRATED AT THE CENTRE.

By Thomas R. Baker.

Most of the plates used were window panes of various shapes and sizes. They were vibrated by rubbing an attached glass rod. The tubes, which were about $\frac{3}{16}$ of an inch in diameter and 20 inches long, were attached at right angles to the face of the plate with sealing wax. The support for the plate was a rubber cap, the common lead-pencil eraser, fitted on the end of a post projecting from a disk of lead. A short rubber-capped lead pencil fixed upright in a wooden block answers the purpose just as well.

The plate was balanced on the support, the tube standing upright and held loosely between the thumb and forefinger of the left hand. Then catching the tube between the moistened thumb and forefinger of the right hand and rubbing downward the vibrations of the plate were produced.

Different tones were obtained from the same plate by varying the pressure and the position of the thumb and finger. Each plate yielded from *one* to *six* tones, the number increasing with the size and thinness of the plate. A plate 10 in. by 14 gave *six* tones, one 4×4 gave *two*, and one 3×3 gave but *one*.

The interval between the lowest and second tones of a 10×12 plate was *two octaves and one tone;* between the second and third, a *diminished sixth;* and between the third and fourth, an *augmented fourth*. The greatest interval found between the lowest and highest tones of a plate was more than *four* octaves, and the greatest interval observed, considering the tones of all the plates tried, was more than *five* octaves.

Plates were reduced in size by cutting strips an inch broad from them, and a test was made of the tones of each plate thus produced. A plate 12 inches square was cut down to 11 in. by 12, then to 10x10, and so on until it was reduced to one 2 inches square. By this operation there was furnished a series of eleven plates closely alike in thickness and structure.

The intervals between consecutive tones of each plate of this series down to the plate 7x7 were almost uniform, namely; *two octaves and a fourth* between the lowest and 2nd tones, a *seventh* between the 2nd and 3d, and a *fourth* between the 3d and 4th. From the plate 8x8 to that 3x3 the intervals between the lowest aud 2nd tones were almost uniform, being about *one octave and a fourth*. The other intervals were variable. The difference in pitch of corresponding tones of consecutive plates was with few exceptions, uniform down to the plate 7x7, namely; *three semitones*.

The following is a summary of the facts derived from these experiments: 1. The difference in pitch of the lowest and 2nd tones of all plates tried between the sizes 10 in. by 14, and 7 in. by 7, was *two octaves* to *two octaves and a fourth*, and the difference in pitch of corresponding tones of square plates between the sizes 8 in. by 8, and 3 in. by 3 was *one octave and a fourth*. 2. The intervals between the tones of plates giving *not more than five* tones diminished as the pitch increased, but this was not true of plates giving *more than five* tones. 3. The pitch of tones given by a series of plates which varied in size as the square of a series of numbers whose common difference is one made a sudden leap from one uniform scale to another.

The forms of these variations were learned in the usual way by vibrating the plates with sand sprinkled over them. The figures were copied by placing the plate over paper which had been wet with a solution of potassium bichromate and dried in the dark. The plate and paper were exposed to diffused light or to the vertical rays of the sun. The paper not hid by the sand soon darkened and when this change had taken place the plate was removed and a lead pencil run along the bands of lighter colored paper representing the sand lines. This paper was then placed on white paper and the figures copied by pressure. About 150 sand figures were copied and traced.

The vibrating of plates at the centre as here described, seems to be the best method for class illustration, the main object being to show the formation of sand figures. To vibrate a plate at the centre in this way, expensive apparatus is not needed, a pane of window glass, a glass tube and a rubber eraser—the essential articles—being procured at the cost of a few cents. To vibrate a plate in the ordinary way, a clamp and bow costing several dollars are necessary. Moreover a plate vibrated at the centre will, I think, yield to the ordinary experimenter more tones than one vibrated at the edge.

A simple method of showing the vibration in parts of a rod and a string was suggested by the vibrating plate.

The end of a piece of glass tubing was drawn into a long fine thread, and the tube attached with sealing wax to a long narrow plate near one end. Then when the plate was vibrated so as to yield a low tone, the glass thread vibrates in parts forming a series of spindle-like segments.

A piece of sewing thread was stretched from one end of the narrow plate to the other over the free end of the vibrating rod and fastened to the plate with bees-wax. Then at a low tone of the plate the thread vibrated in segments.

TYPES OF POTTERY.

By Prof. Edw. S. Morse.

The earlier types belonging to the shell heaps of Japan were described and illustrated by specimens from each of the deposits examined by Prof. Morse and his special students.

The pottery of Yeso was nearly all cord-marked, while the shell heap pottery of the middle of Japan had a much less proportion cord-marked.

In the southern portions of Japan, at Higo, cord-marked pottery was extremely rare.

He remarked on the extreme diversity in the shape and ornamentation of the pottery in different places in Japan.

The pottery of Yeso resembling the pottery of the Northern United States; the pottery from the central portions of Japan finding their resemblance to the pottery found in Porto Rico and Jamaica. He also spoke of the hard blue pottery supposed to be Korean, and associated with it a red pottery, which might have been made by the same people. This was lathed-turned. Other forms were mentioned and illustrated by examples.

of the ecliptic whose longest and shortest day, for our northern hemisphere, would coincide with the north and south plane, passing through the Alpine focus and also through the node of intersection for the terrestrial and magnetic Equator. This gives us one great circle from Behring's Straits to its antipodal Antarctic, due south from Mt. Rosa; the other from Scandinavia, at the Arctic Circle, to the antipodal point on the Antarctic, which will be found due south from Behring's Straits. As these ran through the northern hemisphere, the course of one from the volcanoes of Sumatra is nearly parallel to the formerly described Asiatic continental trend as well as the Japan Gulf Stream, and nearly parallel again through North and South America to said Asiatic trend prolonged, whereby a region is inclosed of Nevada geysers, New Madrid earthquake region, Arkansas and Virginia hot springs, Cuban, Venezuelan, Grenadan, Peruvian, and Chilean volcanic and earthquake regions. The course of the other, while running nearly parallel to the North American east coast trend, is from the thirty-nine volcanoes (see Dana's Manual, p. 703) of Central America to the geyser and volcanoes of Iceland, thus inclosing between it and the North American trend our Gulf Stream, probably even aiding to heat it; while on the opposite side of the globe the inclosed line embraces the Hindoo Cush and Western Himalaya elevations; the disturbed regions of Hindostan and islands in the Bay of Bengal (some brought up within the Historical Period) as well as the numerous volcanoes of Sumatra.

The evident connection of these laws with Terrestrial Magnetism, Mining and Mineralogy, Archæology and Ethnology, is left for future discussion.

AN INVESTIGATION OF THE VIBRATIONS OF PLATES VIBRATED AT THE CENTRE.

By THOMAS R. BAKER.

MOST of the plates used were window panes of various shapes and sizes. They were vibrated by rubbing an attached glass rod. The tubes, which were about $\frac{3}{16}$ of an inch in diameter and 20 inches long, were attached at right angles to the face of the plate with sealing wax. The support for the plate was a rubber cap, the common lead-pencil eraser, fitted on the end of a post projecting from a disk of lead. A short rubber-capped lead pencil fixed upright in a wooden block answers the purpose just as well.

The plate was balanced on the support, the tube standing upright and held loosely between the thumb and forefinger of the left hand. Then catching the tube between the moistened thumb and forefinger of the right hand and rubbing downward the vibrations of the plate were produced.

Different tones were obtained from the same plate by varying the pressure and the position of the thumb and finger. Each plate yielded from *one* to *six* tones, the number increasing with the size and thinness of the plate. A plate 10 in. by 14 gave *six* tones, one 4×4 gave *two*, and one 3×3 gave but *one*.

The interval between the lowest and second tones of a 10×12 plate was *two octaves and one tone;* between the second and third, a *diminished sixth;* and between the third and fourth, an *augmented fourth*. The greatest interval found between the lowest and highest tones of a plate was more than *four* octaves, and the greatest interval observed, considering the tones of all the plates tried, was more than *five* octaves.

Plates were reduced in size by cutting strips an inch broad from them, and a test was made of the tones of each plate thus produced. A plate 12 inches square was cut down to 11 in. by 12, then to 10x10, and so on until it was reduced to one 2 inches square. By this operation there was furnished a series of eleven plates closely alike in thickness and structure.

The intervals between consecutive tones of each plate of this series down to the plate 7x7 were almost uniform, namely; *two octaves and a fourth* between the lowest and 2nd tones, a *seventh* between the 2nd and 3d, and a *fourth* between the 3d and 4th. From the plate 8x8 to that 3x3 the intervals between the lowest aud 2nd tones were almost uniform, being about *one octave and a fourth*. The other intervals were variable. The difference in pitch of corresponding tones of consecutive plates was with few exceptions, uniform down to the plate 7x7, namely; *three semitones*.

The following is a summary of the facts derived from these experiments: 1. The difference in pitch of the lowest and 2nd tones of all plates tried between the sizes 10 in. by 14, and 7 in. by 7, was *two octaves* to *two octaves and a fourth*, and the difference in pitch of corresponding tones of square plates between the sizes 8 in. by 8, and 3 in. by 3 was *one octave and a fourth*. 2. The intervals between the tones of plates giving *not more than five* tones diminished as the pitch increased, but this was not true of plates giving *more than five* tones. 3. The pitch of tones given by a series of plates which varied in size as the square of a series of numbers whose common difference is one made a sudden leap from one uniform scale to another.

The forms of these variations were learned in the usual way by vibrating the plates with sand sprinkled over them. The figures were copied by placing the plate over paper which had been wet with a solution of potassium bichromate and dried in the dark. The plate and paper were exposed to diffused light or to the vertical rays of the sun. The paper not hid by the sand soon darkened and when this change had taken place the plate was removed and a lead pencil run along the bands of lighter colored paper representing the sand lines. This paper was then placed on white paper and the figures copied by pressure. About 150 sand figures were copied and traced.

The vibrating of plates at the centre as here described, seems to be the best method for class illustration, the main object being to show the formation of sand figures. To vibrate a plate at the centre in this way, expensive apparatus is not needed, a pane of window glass, a glass tube and a rubber eraser—the essential articles—being procured at the cost of a few cents. To vibrate a plate in the ordinary way, a clamp and bow costing several dollars are necessary. Moreover a plate vibrated at the centre will, I think, yield to the ordinary experimenter more tones than one vibrated at the edge.

A simple method of showing the vibration in parts of a rod and a string was suggested by the vibrating plate.

The end of a piece of glass tubing was drawn into a long fine thread, and the tube attached with sealing wax to a long narrow plate near one end. Then when the plate was vibrated so as to yield a low tone, the glass thread vibrates in parts forming a series of spindle-like segments.

A piece of sewing thread was stretched from one end of the narrow plate to the other over the free end of the vibrating rod and fastened to the plate with bees-wax. Then at a low tone of the plate the thread vibrated in segments.

TYPES OF POTTERY.

By PROF. EDW. S. MORSE.

The earlier types belonging to the shell heaps of Japan were described and illustrated by specimens from each of the deposits examined by Prof. Morse and his special students.

The pottery of Yeso was nearly all cord-marked, while the shell heap pottery of the middle of Japan had a much less proportion cord-marked.

In the southern portions of Japan, at Higo, cord-marked pottery was extremely rare.

He remarked on the extreme diversity in the shape and ornamentation of the pottery in different places in Japan.

The pottery of Yeso resembling the pottery of the Northern United States; the pottery from the central portions of Japan finding their resemblance to the pottery found in Porto Rico and Jamaica. He also spoke of the hard blue pottery supposed to be Korean, and associated with it a red pottery, which might have been made by the same people. This was lathed-turned. Other forms were mentioned and illustrated by examples.

of the ecliptic whose longest and shortest day, for our northern hemisphere, would coincide with the north and south plane, passing through the Alpine focus and also through the node of intersection for the terrestrial and magnetic Equator. This gives us one great circle from Behring's Straits to its antipodal Antarctic, due south from Mt. Rosa; the other from Scandinavia, at the Arctic Circle, to the antipodal point on the Antarctic, which will be found due south from Behring's Straits. As these ran through the northern hemisphere, the course of one from the volcanoes of Sumatra is nearly parallel to the formerly described Asiatic continental trend as well as the Japan Gulf Stream, and nearly parallel again through North and South America to said Asiatic trend prolonged, whereby a region is inclosed of Nevada geysers, New Madrid earthquake region, Arkansas and Virginia hot springs, Cuban, Venezuelan, Grenadan, Peruvian, and Chilean volcanic and earthquake regions. The course of the other, while running nearly parallel to the North American east coast trend, is from the thirty-nine volcanoes (see Dana's Manual, p. 703) of Central America to the geyser and volcanoes of Iceland, thus inclosing between it and the North American trend our Gulf Stream, probably even aiding to heat it; while on the opposite side of the globe the inclosed line embraces the Hindoo Cush and Western Himalaya elevations; the disturbed regions of Hindostan and islands in the Bay of Bengal (some brought up within the Historical Period) as well as the numerous volcanoes of Sumatra.

The evident connection of these laws with Terrestrial Magnetism, Mining and Mineralogy, Archæology and Ethnology, is left for future discussion.

AN INVESTIGATION OF THE VIBRATIONS OF PLATES VIBRATED AT THE CENTRE.

By THOMAS R. BAKER.

MOST of the plates used were window panes of various shapes and sizes. They were vibrated by rubbing an attached glass rod. The tubes, which were about $\frac{3}{16}$ of an inch in diameter and 20 inches long, were attached at right angles to the face of the plate with sealing wax. The support for the plate was a rubber cap, the common lead-pencil eraser, fitted on the end of a post projecting from a disk of lead. A short rubber-capped lead pencil fixed upright in a wooden block answers the purpose just as well.

The plate was balanced on the support, the tube standing upright and held loosely between the thumb and forefinger of the left hand. Then catching the tube between the moistened thumb and forefinger of the right hand and rubbing downward the vibrations of the plate were produced.

Different tones were obtained from the same plate by varying the pressure and the position of the thumb and finger. Each plate yielded from *one* to *six* tones, the number increasing with the size and thinness of the plate. A plate 10 in. by 14 gave *six* tones, one 4×4 gave *two*, and one 3×3 gave but *one*.

The interval between the lowest and second tones of a 10×12 plate was *two octaves and one tone;* between the second and third, a *diminished sixth;* and between the third and fourth, an *augmented fourth*. The greatest interval found between the lowest and highest tones of a plate was more than *four* octaves, and the greatest interval observed, considering the tones of all the plates tried, was more than *five* octaves.

Plates were reduced in size by cutting strips an inch broad from them, and a test was made of the tones of each plate thus produced. A plate 12 inches square was cut down to 11 in. by 12, then to 10x10, and so on until it was reduced to one 2 inches square. By this operation there was furnished a series of eleven plates closely alike in thickness and structure.

The intervals between consecutive tones of each plate of this series down to the plate 7x7 were almost uniform, namely; *two octaves and a fourth* between the lowest and 2nd tones, a *seventh* between the 2nd and 3d, and a *fourth* between the 3d and 4th. From the plate 8x8 to that 3x3 the intervals between the lowest aud 2nd tones were almost uniform, being about *one octave and a fourth*. The other intervals were variable. The difference in pitch of corresponding tones of consecutive plates was with few exceptions, uniform down to the plate 7x7, namely; *three semitones*.

The following is a summary of the facts derived from these experiments: 1. The difference in pitch of the lowest and 2nd tones of all plates tried between the sizes 10 in. by 14, and 7 in. by 7, was *two octaves* to *two octaves and a fourth*, and the difference in pitch of corresponding tones of square plates between the sizes 8 in. by 8, and 3 in. by 3 was *one octave and a fourth*. 2. The intervals between the tones of plates giving *not more than five* tones diminished as the pitch increased, but this was not true of plates giving *more than five* tones. 3. The pitch of tones given by a series of plates which varied in size as the square of a series of numbers whose common difference is one made a sudden leap from one uniform scale to another.

The forms of these variations were learned in the usual way by vibrating the plates with sand sprinkled over them. The figures were copied by placing the plate over paper which had been wet with a solution of potassium bichromate and dried in the dark. The plate and paper were exposed to diffused light or to the vertical rays of the sun. The paper not hid by the sand soon darkened and when this change had taken place the plate was removed and a lead pencil run along the bands of lighter colored paper representing the sand lines. This paper was then placed on white paper and the figures copied by pressure. About 150 sand figures were copied and traced.

The vibrating of plates at the centre as here described, seems to be the best method for class illustration, the main object being to show the formation of sand figures. To vibrate a plate at the centre in this way, expensive apparatus is not needed, a pane of window glass, a glass tube and a rubber eraser—the essential articles—being procured at the cost of a few cents. To vibrate a plate in the ordinary way, a clamp and bow costing several dollars are necessary. Moreover a plate vibrated at the centre will, I think, yield to the ordinary experimenter more tones than one vibrated at the edge.

A simple method of showing the vibration in parts of a rod and a string was suggested by the vibrating plate.

The end of a piece of glass tubing was drawn into a long fine thread, and the tube attached with sealing wax to a long narrow plate near one end. Then when the plate was vibrated so as to yield a low tone, the glass thread vibrates in parts forming a series of spindle-like segments.

A piece of sewing thread was stretched from one end of the narrow plate to the other over the free end of the vibrating rod and fastened to the plate with bees-wax. Then at a low tone of the plate the thread vibrated in segments.

TYPES OF POTTERY.

By PROF. EDW. S. MORSE.

The earlier types belonging to the shell heaps of Japan were described and illustrated by specimens from each of the deposits examined by Prof. Morse and his special students.

The pottery of Yeso was nearly all cord-marked, while the shell heap pottery of the middle of Japan had a much less proportion cord-marked.

In the southern portions of Japan, at Higo, cord-marked pottery was extremely rare.

He remarked on the extreme diversity in the shape and ornamentation of the pottery in different places in Japan.

The pottery of Yeso resembling the pottery of the Northern United States; the pottery from the central portions of Japan finding their resemblance to the pottery found in Porto Rico and Jamaica. He also spoke of the hard blue pottery supposed to be Korean, and associated with it a red pottery, which might have been made by the same people. This was lathed-turned. Other forms were mentioned and illustrated by examples.

MOUNT HAMILTON, CAL.

We present our readers with a view of Mount Hamilton, the site selected for the Lick Observatory. Previous to any decision being finally arrived at, Mr. S. W. Burnham, of Chicago, was directed to make a report upon the fitness of the selection for the purpose. He states that "in accordance with an arrangement made with the Trustees of the James Lick bequest to make a series of astronomical observations for the purpose of determining the atmospheric condition of that location, with reference to its adaptation for the proposed Lick Observatory (originally suggested by Prof. Edward S. Holden, in 1874, and subsequently approved by Prof. Simon Newcomb, in 1879), I left Chicago on August 10, 1879, arrived in San Francisco on the evening of August 15; and left for Mt. Hamilton the next morning in company with Capt. Richard S. Floyd, President of the Trustees. The summit was reached during the afternoon of the same day. The telescope, which was already on the ground, was hurriedly unpacked, temporarily set up in the observatory, and used that night."

SITUATION OF MT. HAMILTON.

The city of San Jose, the nearest point of railroad connection from Mt. Hamilton, is 50 miles south of San Francisco. Mt. Hamilton, by the highway, is 26 miles from San Jose, nearly east, and is reached by a good road constructed two or three years since by the county of Santa Clara. In order to keep the grade within the limit of six feet in one hundred, the last portion of the road is carried up the ridges of the mountain by a circuitous route. The distance between the Observatory and San Jose, in an airline, is only 13 miles.

The approximate geographical of the Observatory Peak is:

Longitude	121° 36′ 40″ W.
Latitude	37° 21′ 3″ N.

The elevation of this point is 4,250 feet above the level of the sea. The north peak, which is about three-fourths of a mile distant, is 140 feet higher. The ridge between is a good trail connecting the two peaks. The sides of the mountain, in most directions, are very steep, and form an acute angle at the summit. The view from the peaks is unobstructed in every direction, there being no higher ground within a radius of 100 miles. In this connection the e report of Messrs. Herrmann Bros., the engineers who surveyed the road, will be of interest:

"The scope of the horizon from Mt. Hamilton takes in more ground, according to Prof. Whitney's judgment, than almost any similar peak in the United States, there being no obstruction to the view from any quarter. It is remarkably free from fogs and clouds, as we had ample occasion to observe during our last winter's stay on the mountain when locating the road. The bearings of the most notable objects are as follows, the distances being taken, when out of our county, from our most reliable maps:

Mt. Loma Prieta	S. 35° 5′ W., 19½	miles.
Mt. Thayer	S. 51° 18′ W., 19¾	"
Mt. Poucher	S. 38° 35′ W., 6	"
Block Mountain	S. 87° W., 27½	"
Mt. Tamalpais	N. 51° 20′ W., 66	"
Mission Peak	N. 47° 55′ W., 16	"
Mt. Story	N. 25° 45′ W., 10¾	"
Mt. Diablo	N. 21° 45′ W., 39½	"
Mt. Sautana	S. 37° E., 35	"
Murphy's Peak	S. 6° 5′ W., 15	"

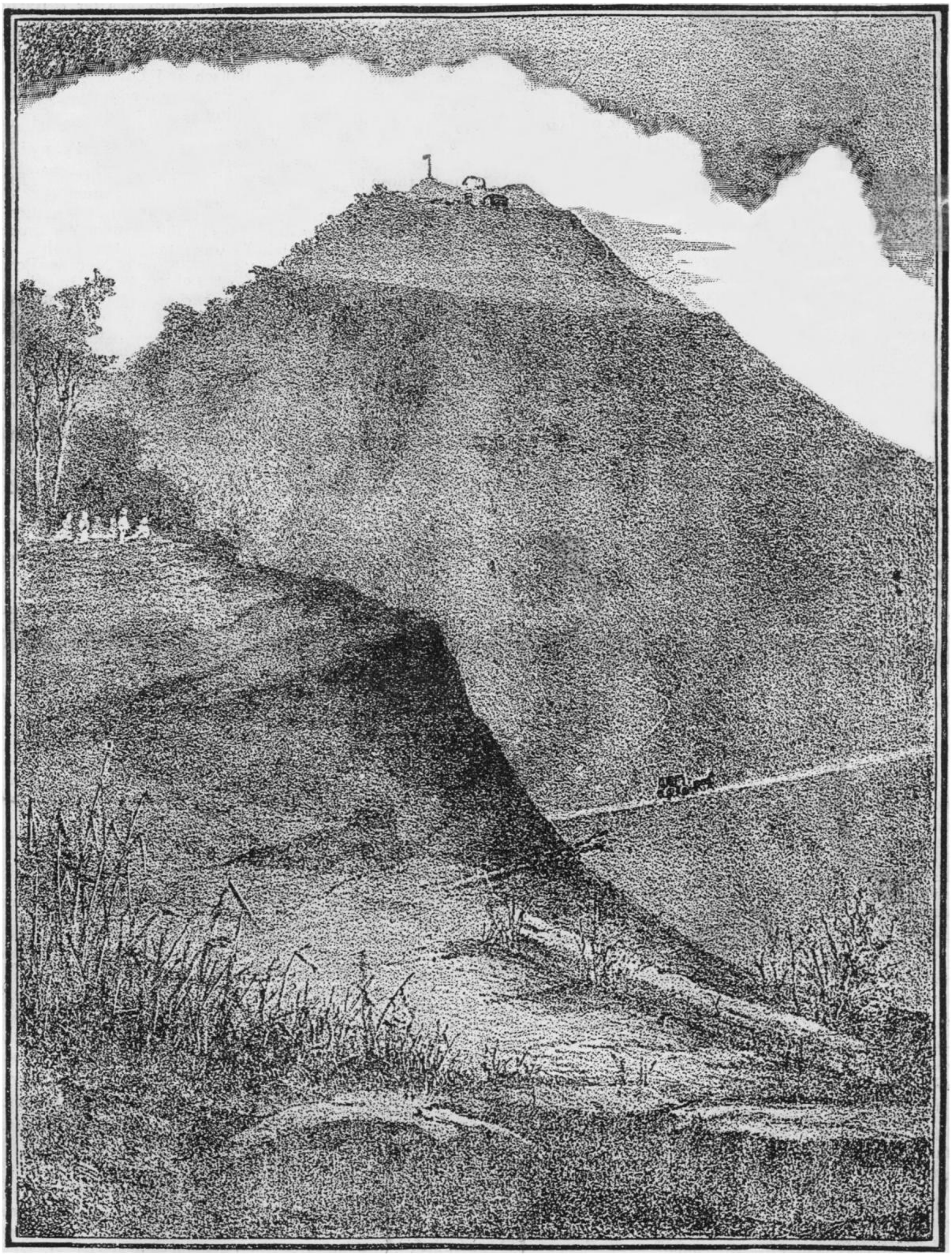
None of these points reach the altitude of Mt. Hamilton. Of those within a radius of 20 miles the Loma Prieta reaches 3,800 feet, Thayer 3,550, and Block Mt. 2,800. All the rest are between 1,500 and 2,500 feet. Of the further peaks Mt. Diablo is 3,856.

The formation of Mt. Hamilton, as of all the near surrounding ridges, is of trap rock. The high points, not worn down by the atmosphere and the action of the rain, are, therefore, very hard as soon as the upper crust is removed. In building the road we struck this hard rock at six or seven points on and near the cone, with a good prospect of finding it continuous and getting harder in the same proportion in going deeper. It has broken through the older formations at several points, near the base of the mountain, where it shows the same character, only intensified. At the top it appears as a greenstone porphyr, with small larkspur veins, exceedingly hard, without any defined strata, but in large boulders worn smooth, and generally flat on one side, and cemented together by other material less hard and easier to work. At a great many places the metamorphic slate, uplifted by the later upheavals, shows in considerable bodies, one of them being on the south side of the Observatory Peak, and nearly opposite one of the hardest points of porphyr."

At sunset the Pacific Ocean is seen over the summit of the Coast Range at various points, and occasionally a snow-covered mountain was seen in a northerly direction, supposed to be Lasson Butte, the distance of which is about 175 miles. The great range of the Sierra Nevada, about 130 miles distant, came out sharp and distinct at sunrise. There were many very distant peaks in the east and south-east which could not conveniently be identified. As an illustration of the transparency of the atmosphere, I may mention a fact communicated to me by Prof. Davidson, of the U. S. Coast Survey. He was at work in the Sierra Nevada, at an altitude of over 10,000 feet, and was able to see with the naked eye the five-inch mirror of a heliotrope 175 miles distant.

For a critical *resumé* of the work done by Mr. W. S. Burnham upon Mount Hamilton, and the results he arrived at, we refer our readers to the article on "Mountain Sites for Astronomical Observatories," in our last week's issue.

The opinion of Mr. Burnham is summed up in the last words of his report when he observes that "Mount Hamilton would be much more desirable, and more could be accomplished there with a large telescope than at any other place where an observatory has yet been established. So far as there have been opportunities for judging, it is obviously an appropriate place for erecting and maintaining the telescope to be constructed under the Lick deed of trust, and required to be "superior to, and more powerful than, any telescope ever yet made." With such an instrument in such a field wonderful discoveries may be made. The only limit to the size of the object glass would be found in the mechanical difficulties attending its construction. No refractor that can be made in the present state of the art would be unsuitable, so far as the observed conditions would enable one to judge. It is impossible to overestimate the great discoveries which might be made and the important work done with a first-class object glass of thirty inches or more aperture, as perfect in all respects as the instrument at the Naval Observatory at Washington."



VIEW OF MOUNT HAMILTON, CAL.—SITE OF THE LICK OBSERVATORY.

(Fac simile from official report.)

MEETING OF THE AMERICAN SOCIETY OF MICROSCOPISTS AT DETROIT.

The third annual meeting of this society began at Detroit Tuesday, August 17th. The meeting was held in the Detroit Female Seminary, a building well adapted to the purpose, as, besides the large hall where the regular sessions were held, it was well provided with rooms of sufficient capacity for the accommodation of the leading manufacturers of microscopes and accessories, thus enabling them to make a fine exhibit of the latest and most approved forms of instruments and accessories. This, we may mension, is an interesting feature of the meetings of this society, which if not carried too far, may be productive of a great amount of value to microscopic students in enabling them to examine a large variety of instruments and apparatus, which otherwise could not be done without visiting the leading centres of manufacture at considerable expense.

The meeting was opened by the retiring president, Dr. R. H. Ward, of Troy,N.Y., introducing to the society the president-elect, Prof. H. L. Smith, of Geneva. N. Y. After the applause which greeted the new president had subsided, prayer was offered by the Rev. W. W. Hammond, of Detroit.

Prof. E. C. Wetmore, president of the Griffith Club of Microscopy, on behalf of that club, extended to the visiting society an address of welcome, and then introduced the Hon. J. J. Bagley, who stated that it was with pleasure he welcomed the visitors to the beautiful city of Detroit.

Regular business was then taken up. Secretary Prof. A. H. Tuttle announced that the Executive Committee had recommended to membership the following gentlemen, who were elected: Hiram A. Cutting, Linenburgh, Vt.; J. W. Crumbaugh, M.D., Lancaster, Pa.; Jno. Phinn, Esq., Editor *American Journal of Microscopy*, New York City; L. R. Sexton, Rochester, N. Y; S. O. Gleason, M.D., Elmira, N. Y.; T. S. Updegraff, M. D., Elmira, N. Y.; Lee H. Smith, M.D., Buffalo, N. Y.; F. O. Jacobs, Newark, Ohio; W. G. Lapham, Northville, Mich.; Nathan W. Lord, Columbus, Ohio; Sydney H. Short, Denver, Colorado; Gen. Wm. Humphrey and J. F. Main, M.D., Jackson, Mich.; O. W. Owen, M.D., Prof. E. C. Wetmore, Chas. R. Ferris and Fred Seymour, Detroit, Mich.

AFTERNOON SESSION.

The meeting was called to order by President Smith, and the proceedings commenced by Mr. George E. Fell, of Buffalo, N. Y., who gave a description of a series of plates he had prepared to illustrate on a large scale the structure of the human tooth. The speaker said these plates constituted a series of enlarged sectional drawings (cut transversely) exhibiting the structure, microscopical and general, of a human molar tooth. The average size of the drawings is six inches square.

Beginning with a top view of the crown surface of the tooth the student is successively introduced to the structure and conformation of the enamel, cementum, dentine and pulp cavity, up to the fangs of the tooth, as located in the alveolus of the superior maxillary bone. Mr. Fell stated that the drawings were prepared from a series of sections of a tooth prepared by himself for the microscopical study of its structure. His object in preparing them was to add another to the numerous aids offered to the medical and dental student in becoming acquainted with the structure of the human tooth. The plates were made up of a series of drawings overlapping each other, and finely colored, so that the various sections could be unfolded and each successive layer, of the interior structure of the tooth, consecutively exhibited. For the purpose of locating the positions of the different sections an enlarged side-elevation of a tooth (a modified copy of that prepared by Dr. F. G. Lemercier, of Paris), was used. upon which the position of the sections were defined.

Professor D. S. Kellicott, of Buffalo, N. Y., read a valuable paper upon the "*Lernescera Tortua*" a parasite harbored by the cat-fish or bull-head, and found in the river water near Buffalo. The reader stated that he had not found a locality where the parasite was at all abundant. He had only one specimen prepared for observation. It was found on a fish of ordinary size, and was deeply buried in a tumor, caused by its own presence, just back of the pectoral fin of the fish. After extraction it remained alive for several hours. The parasite could be distinguished by the naked eye, but to make out its minute structure, the best lens was required. The reader stated that with a Bausch and Lomb ½ inch objective of 98° angular aperture he had obtained the best results, making out structure which he was unable to see satisfactorily with lenses of a lower angular aperature. A very full description was given of this newly described Lemeoceran, and the whole address was attentively listened to by those present. A paper of this description by Prof. Kellicott, is specially valuable from the fact that he is one of the best authorities upon the subject of fish parasites in the country, having discovered many new species on fish inhabiting the inland lakes and rivers.

The next paper was on "The Relation of Medium-Power Objectives to Micro-Biology," by Mr. W. G. Lapham, of Northville, Michigan. The paper was of interest to students, giving the effects of the use of different objectives, and was full of hints and statements deduced from observation and the speaker's experience. The author thought that there ought to be a great National University, with a library and professors of Microscopy, and indeed of every branch of that particular science. The deduction from the essay was that with a "four-tenth objective any one could see all that they wanted to in micro-biological research."

It is quite unnecessary to state that this view was controverted by many present. While it may be admitted that with a *properly constructed* wide angled $\frac{4}{10}$ objective, very much that is ordinarily observed in micro-biological work may be seen, when eye pieces of different powers are used. To confine the work of the microscope of to-day to such powers as might be obtained with these combinations would obliterate, to a great extent, the widest field at present open to the microscopic student in original research President Smith commented upon the paper and raised objections to some of the views propounded. Secretary Tuttle also differed with the author on some points of his essay.

Mr. C. M. Vorce, of Cleveland, Ohio, read a paper on "Penetration of Objectives; Is it a Defect or an Advantage?" This paper was a very sensible *resumé* of a subject which has occupied the minds of microscopists for a long period of time, and upon which differences of opinion still exist. Mr. Vorce took the ground that there is yet work for the penetrating lens as well as the lens of wide angle with less penetration. Of the two series he would prefer the wide angled, defining, comparatively non-penetrating lenses, if the microscopist was unable to possess both series.

Following the election of new members the Society adjourned until 10 o'clock Wednesday morning.

The second day's session opened with a good attendance of members and visitors.

After the reading of minutes, etc., the executive committee reported the following as approved applicants for membership: The Rev. Wm. D'Orville Doty, Rochester, N. Y.; Rosa M. Redding, Newcastle, Ind.; Chas. Shepard, M. D., Grand Rapids, Mich.; W. B. Sprague, M. D., Detroit; Allen Y. Moore, Coldwater, Mich.; W. G. White, Buffalo, N. Y.; William A. Clapp, New Albany, Ind.; John Sloane, New Albany, Ind.; Richard J. Mohr, Fairfield, Iowa; Albert McCalla, Fairfield, Iowa. The gentlemen named were accordingly elected members of the society.

Prof. C. M. Vorce read the first paper of the day, which was entitled "The Microscopic Examination of Writings for the detection of forgery," etc.

The speaker treated the subject at length, saying that he had a great deal of interest in the matter, and directed his attention both to the verification and signatures and general writing. He had considered, first, the general characteristics of writing; second, special characteristics, modifications of, or departures from, general characteristics. There were five elements which determined the character of a person's handwriting: The paper, the pen, the ink, the personal qualifications of the writer, and the conditions under which the writing was done. Any one of these being changed from the ordinary conditions, the microscopic conditions of the writing were almost sure to be changed also. So far as the paper is concerned, its glazed

surface is the only characteristic which affects writing. The harder and smoother the surface the better defined is the writing upon it, and the better chance there is of determining any erasure, change, or interpolation. On paper of good quality, with a good pen and readily flowing ink, the lines of writing present a tolerably even contour, depending upon the rapidity, pressure, the amount of ink in the pen, etc. The speaker illustrated at length on the blackboard the various widenings or "webs" which are always found at points where two lines cross, explaining how a variation of speed, a change in the kind of ink and other causes affected this web. Upon rough paper the lines always have a ragged edge; the webbing is, if anything, less than upon hard, smooth paper. As to the pen, he stated that when a steel one was used the paper always showed a distinct groove or cutting on its surface, especially at the edges of the heavy lines, When a pen is old and corroded, the paper looks as though cut with a knife. The various qualities of ink were discussed, together with the effect on the appearance of the writing which copying in a letter press has. Some inks will not write well on paper that has been lithographed, running unevenly, as though the paper were greasy. By the fourth condition, the qualifications of the writer, the speaker meant his skill, method, physical ability, etc. A person much accustomed to writing usually writes at a good speed and without hesitation. The writing, in quality, is apt to look alike at all points on the page, Where writing is done slowly it is not so regular and the curves are not so smooth and geometrical. Where a habitually light writer attempts to make a heavy stroke, the shading is irregular. The same is true where a person accustomed to writing with a heavy stroke attempts to write light. These differences are such that they can be usually discovered with the aid of the microscope, and when a writer concentrates all his faculties on the appearance and character of the writing it never has the easy, flowing appearance which it otherwise would have. The tremor in the writing of aged persons, he stated, it was nearly impossible to imitate. The fifth condition, the circumstances under which the writing was done, had as much to do with its appearance as any other cause. One who habitually uses a flexible gold pen writes very differently with a steel pen. The reverse is equally true. Persons who are accustomed to write sitting usually cannot write as well standing. The practical application of these and other facts in the examination of writing requires patient investigation, much of it apart from the simple use of the microscope. In the great majority of cases the microscopic investigation is utterly useless without a corresponding outside investigation. The signatures to letters are apt to vary more than those written elsewhere. Letters produced as specimens of a person's handwriting are very apt to prove deceptive. Sometimes it is impossible from expert testimony to determine the character of the suspected writing. As an instance, the speaker related that he had in his possession a genuine promissory note in which a man had misspelled his own name in the signature. Had he died and there been a contest as to the signature it could hardly have been decided as anything else than a forgery. Unfortunately, however, the man lived to pay the note, thus spoiling a very good chance for a nice case of expert evidence.

Ex-President Ward discussed this paper at some length, his remarks particularly relating to the individual peculiarities of writers being noticed more or less in their handwriting. He considered it a very important factor in the detection of forgeries, etc.

The next paper was on "Mounting Materials," by Dr. Carl Seiler, of Philadelphia. He said the microscopists of both Europe and America were divided into two classes on this important question. Many believed that balsam should be the only material used in most cases and others as decidedly glycerine. He was of the opinion that all tissues which can be hardened and cut into sections are best mounted in balsam, and such specimens as membranes, hairs, cilia, etc., are best mounted in glycerine. If one wished to show delicate, fine lines he should use glycerine. The advantages of balsam are that it does not destroy colors, makes a specimen clear and does not deteriorate. The disadvantages are that the specimen is apt to shrink, and the process of drying is very slow. The advantages of glycerine are that delicate membranes may be preserved, while its disadvantages are that it always interferes with the coloring. The specimen also tends to deteriorate. Specimens mounted in glycerine are very apt to suffer from leakage. There are substances which in some cases combine the advantages of both, without the disadvantages of either. Among these the speaker mentioned Farrant's medium and Damar's cement.

This topic was discussed by Treasurer Fell; Dr. Younghusband, of Detroit; Dr. Seiler, of Philadelphia; Mr. J. H. Fisher, of Rochester, N. Y.; Mr. C. M. Vorce; W. H. Walmsley, of Philadelphia; Secretary Tuttle; President Smith and others.

The Society adjourned until the afternoon.

Afternoon Session.

At this session President Smith announced the Committee on the Griffith Award as follows, viz.: W. H. Walmsley, Prof. D. S. Kellicott and Mr. J. H. Fisher.

A work on "Angular Aperture of Microscope Objectives," by Dr. Geo. E. Blackham, F. R. M. S., was presented to the Society by the President on behalf of the author, to whom the thanks of the Society were extended.

The discussion of the paper read by Dr. Seiler at the morning session was continued, after which Mr. J. H. Fisher, of Rochester, N. Y., read a very interesting paper entitled "Notes on the Structure, Development, and Position, of a (supposed) Undescribed Flagellate Infusiorium." He referred at first to the but little explored domain of the lowest forms of animal life, which so nearly approach the vegetable.The Infusoriumwhich he described he found in a small pond of stagnant water near Mount Hope. The body of the little animal was shaped like a cylindrical flask, green in color, the mouth resembling the neck of a bottle, and provided with a flagellum presumably for both prehensive and sustentatory purposes. The animalcule was minutely described, with its habits. It had no red eye-speck. Spines were equally distributed over it. It could not be identified, he thought, with any known species. Mr. Fisher provisionally named it *Laguncula piscatoris*.

This paper was discussed by Mr. Lapham, of Northville, Mich., who said he had seen an organism almost identical with it, except that its outer shell was composed of a series of successive plates.

The next paper was by Mr. William H. Walmsley, of Philadelphia, on "The Use of Wax Cells in connection with White Zinc Cement for Fluid Mounts." The methods employed by Mr. Walmsley, which he stated had given him great satisfaction, both as to the durability of the cell and the neatness of the mounts, was essentially the coating of the ordinary wax cell with white zinc cement. He gave his most approved formulae for the preparation of the cement which he discovered quite a number of years ago, and explained his manner of using it. He exhibited slides with cells from four to six years old, which had resisted the action of the fluid contained within them, without any apparent change. The paper was discussed by Mr. Fell, Mr. Fisher, and several other gentlemen. Mr. Walmsley, in reply to a question, said the cement would sometimes turn yellow.

Discussion was here discontinued, and the Society adjourned.

The address of President H. L. Smith was delivered in Whitney's Opera House in the evening. Prof. Smith said he thought they had very great reason to congratulate themselves upon the results attained at the two previous annual meetings. He might also speak of the wonderful improvements which had been made in the microscpe; but these would be less desirable than a discussion of some special question. He announced his subject to be "Deep sea soundings, and the relation of microscopic Algæ to deep sea animal life, with a few remarks upon evolution." He began with a glowing description of the wonders and beauties of the ocean. He then related the various stages by which it became known that it was possible for life to exist at great depths in the sea, and recounted the voyages of the United States vessel *Tuscarora*, and the English vessels *Challenger* and *Lightning* in their efforts to add to human knowledge concerning deep sea life.

Prof. Smith has in his possession material obtained from the soundings made by the *Tuscarora*.

He described the methods used to obtain specimens of the animal and vegetable life to be found three or four miles below the surface of the ocean. He then made a logical and lengthy argument to show that the low forms of deep sea life may furnish another link in the line of proof which is causing scientific men to tend so largely to the evolution theory.

The paper was lengthy and will appear in full in the proceedings of the Society.

Thursday's Session.

Following the reading of the minutes, the Executive Committee reported the name of P. L. Hatch, M. D., of Minneapolis as a member of the Society. He was duly elected.

The secretary also read a report of the Executive Committee in reference to amendments to the constitution. The amendments propose the election of honorary members; the election of secretary and treasurer for three years; making the vice-presidents the auditors of the treasurer's accounts and the treasurer the custodian of the society's property; making the terms of the officers begin at the conclusion of each annual meeting; and providing that if any member shall fail for two years to pay his dues he shall forfeit his membership. The report was accepted and the amendments will come up for action next year.

The Executive Committe also adopted a resolution which was approved by the Society, limiting the sale of the publications on hand, viz: The Proceedings of the Indianapolis and Buffalo meetings, to the members of the society to fill out sets. This action was deemed necessary in view of only a limited number of copies of these proceedings being on hand.

The nominating committee reported the following officers for the ensuing year:

President—J. D. Hyatt, president of the New York Microscopical Society.

Vice Presidents—Geo. E. Blackham, M. D., Dunkirk, N. Y., and W. B. Reoner, M. D., Cleveland, O.

Secretary—Prof. Albert H. Tuttle, Columbus, O.

Treasurer—Geo. E. Fell, Buffalo, N. Y.

Executive Committee—W. H. Brearly, Prof. J. H. Fisher, Prof. Albert H. Chester.

The report was adopted, and they were duly elected.

"Demonstration of Capillary Circulation in Man," was the title of a paper by Dr. D. C. Hawxhurst, of Battle Creek, Mich.

The process of examining the capillary circulation in the lip of a man was described. The lower lip was rolled over a support, and the microscope arranged to view the circulation.

Proper means were taken to steady the head. Clamps were applied to the lips so as to cause an engorgement of the capillary vessels. The method was that of a German scientist.

A power of about 100 diameters was used. The speaker related many interesting experiments, and also explained the effects produced by treating the lip with chloroform, ammonia, acids, glycerine, etc.

The paper was discussed by Dr. Seiler and Mr. Fell, these gentlemen deeming the power too low to be of much service. Dr. Seiler stated that other portions of the body were better adapted for viewing the circulation than the lip, and did not believe the method pursued would be fraught with results of scientific value.

The next paper was by Dr. Carl Seiler, of Philadelphia. "Describing an Improvement in a Microscope Stage." He said last year at a meeting of the society he set forth the necessity for certain improvements in the microscope of the future, one of which was an increased movement of the stage, giving at least four inches play in each direction. Mr. Walmsley, agent for R. & J. Beck, of London, had a binocular made by that English firm, embodying the improvements suggested. Dr. Seiler exhibited the instrument, which he said was particularly valuable in examining large specimens, such as sections of tumors, the vocal organs, or anything requiring a large stage movement to bring the whole of the specimen successively into play.

W. H. Bullock, of Chicago, described a microscope which he had specially arranged for examining rock sections. It was arranged with improved facilities for minute measurements, and had admirable arrangements for illumination of opaque objects, etc.

He also described a new section cutter devised by Prof. Burrill, of Illinois. It had some valuable features about it, notably the manner of holding the knife so that it could be inclined to any angle, with reference to the cutting surface. The well-hole was so arranged that it could be raised and lowered by the micrometer screw, carrying the material to be cut with it. This, it was claimed, offered some advantage over the ordinary "well hole." The arm which carried and supported the knife worked on a brass plate, a corresponding portion of the arm working in a groove cut in the plate, insuring with even an unsteady hand a true and perfect section. It was claimed that sections, the $\frac{1}{1000}$ of an inch in thickness, could be cut with this apparatus.

Mr. W. H. Griffith, of Fairport, N. Y., read the last paper of the Session, describing the new Griffith Club Portable Microscope. He took from his pocket a small narrow case which he opened. Inside was discovered the disjointed parts of a microscope. On placing them together, which was done in a very short time, a very complete instrument was the result. With this little instrument, which we cannot now describe very minutely, the lowest to the highest powers may be used. It is provided with the Society screw, coarse and fine adjustment, the latter on a principle believed to have never before been applied to the microscope, and which is capable of being used on larger stands. The body is composed of tubes which may be drawn out to the standard length of ten inches. In the field this little instrument may be used to advantage, being provided with a wood screw by which it may be secured to the side or branch of a tree or even to a fence-rail. It may then be used with the highest powers. The mirror is hung so that it may be used for transmitted or reflected light. If the owner is in need of a turn-table, by simply arranging a few screws and laying the instrument down on its side he may go to work "ringing" slides to his heart's content. The instrument was made for Mr. Griffith by Messrs. Bausch and Lomb, of Rochester, N. Y.

Prof. T. J. Burrill, Professor of Botany and Horticulture at the Illinois Industrial University, followed with a paper on "The So-called Fire-Blight of the Pear and Twig-Blight of the Apple Tree." His remarks, bearing as they do upon a subject of general interest, are given at some length.

He said the widespread and disastrous disease of the Pear tree, called Fire-blight, and that no less prevalent and alarming one known as Twig-Blight of the Apple tree, are due to the same immediate agency. They are identical in origin, and similar in their pathological characteristics, as *a priori* reasoning might have indicated. The Quince and probably other plants, among which may be named the Butternut, the Lombardy Poplar, and the American Aspen, also suffer from the same disease. From descriptions it was very probable that the "yellows" in the Peach will be found due to a similar cause. The immediate and exciting cause is a living organism producing butyric fermentation in the carbonaceous compounds, starch, etc., in the cells of the affected plants, especially in those of the bark outside of the liber. This organism, if really specifically distinct, is closely allied to the butyric *vibrion* of Pasteur and *Bacillus amylobacter* of Van Tieghem. The disease has been known in this country over 100 years. Various theories have been advanced, and one by one disproved, except the one of fungus growth. In 1878 the writer announced to the Illinois Horticultural Society the discovery of bacteria apparently connected with the disease. His investigations were carried on in an orchard where there were 94 Apple trees, 20 Pear trees and 1 Quince. "After finding myriads of bacteria in the fluids of the diseased tissues," he said, "I inoculated several Pear and Apple trees with what to me, at the time, were unsatisfactory but not uninstructive results. Beginning on the first day of July, 1880, I experimented in various ways at different times upon 66 trees of the Pear, Apple and Quince. Of the numerous applications of the virus upon the unbroken bark or leaves none were successful. Of the inoculations there were successful 63 per cent. of the Pear, 30 per cent. of the Apple, and 100 per cent. of the Quince. Upon the Pear and Quince trees used for the experiments, the disease appeared only in a single case except as the direct result

of the inoculation. This latter was sometimes performed with a knife, sometimes with a needle, always with careful precautions and close subsequent examination. Such experimental limbs as permitted it were cut and preserved like herbarium specimens, and are exhibited with the paper."

The organism found answers fairly to the description of Pasteur's butyric *vibrion*. They are usually oblong, rounded at the ends, mostly connected, two together. Their motions are not rapid, consisting of turning in every direction, and sliding irregularly forward. They are found within closed cells, in the open spaces, and in immense numbers in the viscid exudations from the diseased bark and leaves. The most conspicuous alteration observed in the tissues is the disappearance of the starch grains from the cells. The cell walls are left intact, and the protoplasmic portions remain until after the starch is mostly absorbed and appears to suffer little change until death ensues. The disease is, *par excellence*, one of the bark. The leaves die in consequence of this, or are themselves invaded, either primarily or secondarily, by the destroyer. The progress of the disease is always slow, but the leaves of an affected limb often turn black quite suddenly, perhaps according to meteorologic conditions. In diseased bark, before change has taken place visible from without, and while the leaves are still green and fresh, an active fermentation occurs. This continues until desiccation or the exhaustion of the fermentable substances puts an end to the process. The products of this fermentation are Carbon dioxide and Butyric acid, or a closely similar substance. From the fact that virus from the Pear affects the Apple tree, and vice versa, the speaker argued that the disease was similar in each. The experiments tended to show that the virus is harmless upon the epidermis of healthy plants, nor does it penetrate through the breathing pores. The speaker exhibited drawings of the cells of a healthy plant and a diseased one, showing that the starch in the latter was gradually absorbed. He obtained the virus from diseased trees, where it is exuded, and placed it in distilled water. Upon the dead leaves and branches the virus dried and looked like varnish. When redissolved it retains its vitality. The simple puncture of a bark of a tree with a needle which had been dipped in the virus would be sufficient to cause its death. Prof. Burrill exhibited a small vial containing about a teaspoonful of the virus in solution, which he said was sufficient to destroy a whole orchard.

The Griffith Award.

The committee appointed to examine the specimens of adulterations of commercial articles, and to award the prize, a fine objective, offered by Mr. E. H. Griffith, for the best mounted specimens, reported that C. M. Vorce was the only contestant and that his exhibits of coffee and butter were fine ones. He was therefore entitled to the prize.

President Smith presented it to him in a brief speech, and he accepted, regretting that there had been no other contestants.

A resolution offered by Prof. Burrill, that the president and vice-presidents elect of the society be appointed a committee to report upon some plan for uniformity in size and naming of eye-pieces and tubes, was adopted.

The report of the treasurer Mr. George E. Fell, showed $266.06 on hand, and $450.75 due the society, of which the treasurer regarded $114.69 as being very certain of being paid, making total assets $380.81. The report was adopted.

Prof. Griffith renewed his offer of a ½ inch objective or its equivalent for the best mounted slides showing adulterations in commercial articles, accompanied with the best Thesis upon the specimens submitted. His offer was accepted with thanks.

The Society then adjourned to meet at such time and place as the Executive Committee may determine upon.

The Soiree, which was given in the evening at Merrill Hall, by the members of the American Society and the local microscopists, was in every way successful, and gave great satisfaction.

PRESERVATION OF FOSSIL INSECTS AND PLANTS ON MAZON CREEK.

By J. W. Pike, Vineland, N. J.

Mazon Creek is a branch of the Illinois River, which it joins at Morris, Grundy Co., Ill. It has carved its channel down into the blue shale, which lies above the Morris coal seam, and exposed the ironstone nodules which contain the fossil plants and insects.

Scientific interpretation rests upon comparison. We compare this coalbed with other deposits of carbon, and with those now forming, and ascribe it to an ancient swamp or wet land surface. The shale above is compared with other clay-beds and with the mud of bays and lakes, and we conclude that it is the product of a subsidence and of deeper water. The fringing swamp had advanced upon higher ground, and from it floated the fern leaves and insects that were buried in the accumulating clay of the deeper basins. Leaves that sink upon the mud of a lake will rest flat upon the upper layer, and are buried under the layers that follow. So, too, the leaves in the Mazon shale are conformable to its lines of stratification. Over the shale are beds of sandrock. Compare them with beds of sand and clay now being formed over the peat and clay of the sinking Atlantic coast. It becomes clear that the beds of coal, shale, and sandstone on the Mazon are the product and record of a subsidence in the carboniferous period.

Metamorphism.—The shale immediately around the fossils was transformed into clay-ironstone nodules by the deposition of ferrous carbonate. The concreting force has emanated from the fossils, because the nodules take their general shape. The iron deposit has not merely filled the spaces between the particles of clay, but has crowded them apart and thickened the strata, making them concavo-convex above and below the fossils. Specimens exhibited show the continuity of the strata from the soft outlying shale through the nodules, their thickening and resulting convexity, the conformability of the leaves, etc.

These biological records, like primitive human inscrpitions, were written in nature's picture-language, only they are incomparably more perfect. Like the cuneiform of the Assyrian tablets it was done upon soft clay, but the clay was hardened automatically by the writing itself, and not by baking. Like the castings of the founder who surrounds his models with moist sand, these are casts; but they are casts of the delicate structure of ferns and insects, moulded in fine clay by the gentle touch of moving water. These inscriptions were not carved on the exposed and crumbling surface of monuments, but were sealed up in the concretions, and lay buried in the clay, beyond the reach of wear and decay, during the incalculable periods of the Permian, Triassic, Jurassic, Cretaceous and Teritiary. After the ages of ice and prairie lakes, the waters of the Mazon dug their channel through lake deposits, ice drift, carboniferous sandstone, and into the blue shale. The fossil bearing nodules were washed out of the softer shale, mingled with granitic gravel and strewn in the river bed. Exposure to the air changed the blue ferrous compound to ferric or red oxide. These nodules spontaneously divided into halves, disclosing these exquisite pictures of the ferns, insects and creeping things of the carboniferous lowlands. Per-oxidation continues till the iron separates from the clay. Thus the half of a nodule, with a fern pictured on its surface, may become a geode—a hard red brown shell of iron enclosing the clay in an ochery form in its interior; or it may, in the process, crack and crumble into flakes and fragments. The collector, therefore, must now anticipate the denuding forces, and dig the concretions out of the shale of the river's banks and bottom, and crack them for himself.

CAVES IN JAPAN.

By Prof. Edw. S. Morse.

Mr. Morse described a number of artificially-constructed caves which he had examined in various parts of Japan, giving sketches of them upon the black board.

These caves varied considerably in their design, but agreed in their general proportions, and were evidently intended as receptacles for the dead. They were excavated

of the inoculation. This latter was sometimes performed with a knife, sometimes with a needle, always with careful precautions and close subsequent examination. Such experimental limbs as permitted it were cut and preserved like herbarium specimens, and are exhibited with the paper."

The organism found answers fairly to the description of Pasteur's butyric *vibrion*. They are usually oblong, rounded at the ends, mostly connected, two together. Their motions are not rapid, consisting of turning in every direction, and sliding irregularly forward. They are found within closed cells, in the open spaces, and in immense numbers in the viscid exudations from the diseased bark and leaves. The most conspicuous alteration observed in the tissues is the disappearance of the starch grains from the cells. The cell walls are left intact, and the protoplasmic portions remain until after the starch is mostly absorbed and appears to suffer little change until death ensues. The disease is, *par excellence*, one of the bark. The leaves die in consequence of this, or are themselves invaded, either primarily or secondarily, by the destroyer. The progress of the disease is always slow, but the leaves of an affected limb often turn black quite suddenly, perhaps according to meteorologic conditions. In diseased bark, before change has taken place visible from without, and while the leaves are still green and fresh, an active fermentation occurs. This continues until desiccation or the exhaustion of the fermentable substances puts an end to the process. The products of this fermentation are Carbon dioxide and Butyric acid, or a closely similar substance. From the fact that virus from the Pear affects the Apple tree, and vice versa, the speaker argued that the disease was similar in each. The experiments tended to show that the virus is harmless upon the epidermis of healthy plants, nor does it penetrate through the breathing pores. The speaker exhibited drawings of the cells of a healthy plant and a diseased one, showing that the starch in the latter was gradually absorbed. He obtained the virus from diseased trees, where it is exuded, and placed it in distilled water. Upon the dead leaves and branches the virus dried and looked like varnish. When redissolved it retains its vitality. The simple puncture of a bark of a tree with a needle which had been dipped in the virus would be sufficient to cause its death. Prof. Burrill exhibited a small vial containing about a teaspoonful of the virus in solution, which he said was sufficient to destroy a whole orchard.

The Griffith Award.

The committee appointed to examine the specimens of adulterations of commercial articles, and to award the prize, a fine objective, offered by Mr. E. H. Griffith, for the best mounted specimens, reported that C. M. Vorce was the only contestant and that his exhibits of coffee and butter were fine ones. He was therefore entitled to the prize.

President Smith presented it to him in a brief speech, and he accepted, regretting that there had been no other contestants.

A resolution offered by Prof. Burrill, that the president and vice-presidents elect of the society be appointed a committee to report upon some plan for uniformity in size and naming of eye-pieces and tubes, was adopted.

The report of the treasurer Mr. George E. Fell, showed $266.06 on hand, and $450.75 due the society, of which the treasurer regarded $114.69 as being very certain of being paid, making total assets $380.81. The report was adopted.

Prof. Griffith renewed his offer of a ½ inch objective or its equivalent for the best mounted slides showing adulterations in commercial articles, accompanied with the best Thesis upon the specimens submitted. His offer was accepted with thanks.

The Society then adjourned to meet at such time and place as the Executive Committee may determine upon.

The Soiree, which was given in the evening at Merrill Hall, by the members of the American Society and the local microscopists, was in every way successful, and gave great satisfaction.

PRESERVATION OF FOSSIL INSECTS AND PLANTS ON MAZON CREEK.

By J. W. Pike, Vineland, N. J.

Mazon Creek is a branch of the Illinois River, which it joins at Morris, Grundy Co., Ill. It has carved its channel down into the blue shale, which lies above the Morris coal seam, and exposed the ironstone nodules which contain the fossil plants and insects.

Scientific interpretation rests upon comparison. We compare this coalbed with other deposits of carbon, and with those now forming, and ascribe it to an ancient swamp or wet land surface. The shale above is compared with other clay-beds and with the mud of bays and lakes, and we conclude that it is the product of a subsidence and of deeper water. The fringing swamp had advanced upon higher ground, and from it floated the fern leaves and insects that were buried in the accumulating clay of the deeper basins. Leaves that sink upon the mud of a lake will rest flat upon the upper layer, and are buried under the layers that follow. So, too, the leaves in the Mazon shale are conformable to its lines of stratification. Over the shale are beds of sandrock. Compare them with beds of sand and clay now being formed over the peat and clay of the sinking Atlantic coast. It becomes clear that the beds of coal, shale, and sandstone on the Mazon are the product and record of a subsidence in the carboniferous period.

Metamorphism.—The shale immediately around the fossils was transformed into clay-ironstone nodules by the deposition of ferrous carbonate. The concreting force has emanated from the fossils, because the nodules take their general shape. The iron deposit has not merely filled the spaces between the particles of clay, but has crowded them apart and thickened the strata, making them concavo-convex above and below the fossils. Specimens exhibited show the continuity of the strata from the soft outlying shale through the nodules, their thickening and resulting convexity, the conformability of the leaves, etc.

These biologrical records, like primitive human inscrpitions, were written in nature's picture-language, only they are incomparably more perfect. Like the cuneiform of the Assyrian tablets it was done upon soft clay, but the clay was hardened automatically by the writing itself, and not by baking. Like the castings of the founder who surrounds his models with moist sand, these are casts; but they are casts of the delicate structure of ferns and insects, moulded in fine clay by the gentle touch of moving water. These inscriptions were not carved on the exposed and crumbling surface of monuments, but were sealed up in the concretions, and lay buried in the clay, beyond the reach of wear and decay, during the incalculable periods of the Permian, Triassic, Jurassic, Cretaceous and Teritiary. After the ages of ice and prairie lakes, the waters of the Mazon dug their channel through lake deposits, ice drift, carboniferous sandstone, and into the blue shale. The fossil bearing nodules were washed out of the softer shale, mingled with granitic gravel and strewn in the river bed. Exposure to the air changed the blue ferrous compound to ferric or red oxide. These nodules spontaneously divided into halves, disclosing these exquisite pictures of the ferns, insects and creeping things of the carboniferous lowlands. Per-oxidation continues till the iron separates from the clay. Thus the half of a nodule, with a fern pictured on its surface, may become a geode—a hard red brown shell of iron enclosing the clay in an ochery form in its interior; or it may, in the process, crack and crumble into flakes and fragments. The collector, therefore, must now anticipate the denuding forces, and dig the concretions out of the shale of the river's banks and bottom, and crack them for himself.

CAVES IN JAPAN.

By Prof. Edw. S. Morse.

Mr. Morse described a number of artificially-constructed caves which he had examined in various parts of Japan, giving sketches of them upon the black board.

These caves varied considerably in their design, but agreed in their general proportions, and were evidently intended as receptacles for the dead. They were excavated

of the inoculation. This latter was sometimes performed with a knife, sometimes with a needle, always with careful precautions and close subsequent examination. Such experimental limbs as permitted it were cut and preserved like herbarium specimens, and are exhibited with the paper."

The organism found answers fairly to the description of Pasteur's butyric *vibrion.* They are usually oblong, rounded at the ends, mostly connected, two together. Their motions are not rapid, consisting of turning in every direction, and sliding irregularly forward. They are found within closed cells, in the open spaces, and in immense numbers in the viscid exudations from the diseased bark and leaves. The most conspicuous alteration observed in the tissues is the disappearance of the starch grains from the cells. The cell walls are left intact, and the protoplasmic portions remain until after the starch is mostly absorbed and appears to suffer little change until death ensues. The disease is, *par excellence*, one of the bark. The leaves die in consequence of this, or are themselves invaded, either primarily or secondarily, by the destroyer. The progress of the disease is always slow, but the leaves of an affected limb often turn black quite suddenly, perhaps according to meteorologic conditions. In diseased bark, before change has taken place visible from without, and while the leaves are still green and fresh, an active fermentation occurs. This continues until desiccation or the exhaustion of the fermentable substances puts an end to the process. The products of this fermentation are Carbon dioxide and Butyric acid, or a closely similar substance. From the fact that virus from the Pear affects the Apple tree, and vice versa, the speaker argued that the disease was similar in each. The experiments tended to show that the virus is harmless upon the epidermis of healthy plants, nor does it penetrate through the breathing pores. The speaker exhibited drawings of the cells of a healthy plant and a diseased one, showing that the starch in the latter was gradually absorbed. He obtained the virus from diseased trees, where it is exuded, and placed it in distilled water. Upon the dead leaves and branches the virus dried and looked like varnish. When redissolved it retains its vitality. The simple puncture of a bark of a tree with a needle which had been dipped in the virus would be sufficient to cause its death. Prof. Burrill exhibited a small vial containing about a teaspoonful of the virus in solution, which he said was sufficient to destroy a whole orchard.

The Griffith Award.

The committee appointed to examine the specimens of adulterations of commercial articles, and to award the prize, a fine objective, offered by Mr. E. H. Griffith, for the best mounted specimens, reported that C. M. Vorce was the only contestant and that his exhibits of coffee and butter were fine ones. He was therefore entitled to the prize.

President Smith presented it to him in a brief speech, and he accepted, regretting that there had been no other contestants.

A resolution offered by Prof. Burrill, that the president and vice-presidents elect of the society be appointed a committee to report upon some plan for uniformity in size and naming of eye-pieces and tubes, was adopted.

The report of the treasurer Mr. George E. Fell, showed $266.06 on hand, and $450.75 due the society, of which the treasurer regarded $114.69 as being very certain of being paid, making total assets $380.81. The report was adopted.

Prof. Griffith renewed his offer of a ½ inch objective or its equivalent for the best mounted slides showing adulterations in commercial articles, accompanied with the best Thesis upon the specimens submitted. His offer was accepted with thanks.

The Society then adjourned to meet at such time and place as the Executive Committee may determine upon.

The Soiree, which was given in the evening at Merrill Hall, by the members of the American Society and the local microscopists, was in every way successful, and gave great satisfaction.

PRESERVATION OF FOSSIL INSECTS AND PLANTS ON MAZON CREEK.

By J. W. Pike, Vineland, N. J.

Mazon Creek is a branch of the Illinois River, which it joins at Morris, Grundy Co., Ill. It has carved its channel down into the blue shale, which lies above the Morris coal seam, and exposed the ironstone nodules which contain the fossil plants and insects.

Scientific interpretation rests upon comparison. We compare this coalbed with other deposits of carbon, and with those now forming, and ascribe it to an ancient swamp or wet land surface. The shale above is compared with other clay-beds and with the mud of bays and lakes, and we conclude that it is the product of a subsidence and of deeper water. The fringing swamp had advanced upon higher ground, and from it floated the fern leaves and insects that were buried in the accumulating clay of the deeper basins. Leaves that sink upon the mud of a lake will rest flat upon the upper layer, and are buried under the layers that follow. So, too, the leaves in the Mazon shale are conformable to its lines of stratification. Over the shale are beds of sandrock. Compare them with beds of sand and clay now being formed over the peat and clay of the sinking Atlantic coast. It becomes clear that the beds of coal, shale, and sandstone on the Mazon are the product and record of a subsidence in the carboniferous period.

Metamorphism.—The shale immediately around the fossils was transformed into clay-ironstone nodules by the deposition of ferrous carbonate. The concreting force has emanated from the fossils, because the nodules take their general shape. The iron deposit has not merely filled the spaces between the particles of clay, but has crowded them apart and thickened the strata, making them concavo-convex above and below the fossils. Specimens exhibited show the continuity of the strata from the soft outlying shale through the nodules, their thickening and resulting convexity, the conformability of the leaves, etc.

These biological records, like primitive human inscrpitions, were written in nature's picture-language, only they are incomparably more perfect. Like the cuneiform of the Assyrian tablets it was done upon soft clay, but the clay was hardened automatically by the writing itself, and not by baking. Like the castings of the founder who surrounds his models with moist sand, these are casts; but they are casts of the delicate structure of ferns and insects, moulded in fine clay by the gentle touch of moving water. These inscriptions were not carved on the exposed and crumbling surface of monuments, but were sealed up in the concretions, and lay buried in the clay, beyond the reach of wear and decay, during the incalculable periods of the Permian, Triassic, Jurassic, Cretaceous and Teritiary. After the ages of ice and prairie lakes, the waters of the Mazon dug their channel through lake deposits, ice drift, carboniferous sandstone, and into the blue shale. The fossil bearing nodules were washed out of the softer shale, mingled with granitic gravel and strewn in the river bed. Exposure to the air changed the blue ferrous compound to ferric or red oxide. These nodules spontaneously divided into halves, disclosing these exquisite pictures of the ferns, insects and creeping things of the carboniferous lowlands. Per-oxidation continues till the iron separates from the clay. Thus the half of a nodule, with a fern pictured on its surface, may become a geode—a hard red brown shell of iron enclosing the clay in an ochery form in its interior; or it may, in the process, crack and crumble into flakes and fragments. The collector, therefore, must now anticipate the denuding forces, and dig the concretions out of the shale of the river's banks and bottom, and crack them for himself.

CAVES IN JAPAN.

By Prof. Edw. S. Morse.

Mr. Morse described a number of artificially-constructed caves which he had examined in various parts of Japan, giving sketches of them upon the black board.

These caves varied considerably in their design, but agreed in their general proportions, and were evidently intended as receptacles for the dead. They were excavated

in soft rock on the sides of hills—the apertures small and in some cases showing grooves for the adjustment of slabs of rock or other material to close them. The absence of remains in these caves could be explained from the fact that in earlier times outlaws and refugees often used them as places of shelter and residence, and laws had finally been passed by the governors of some of the districts causing the caves to be filled up, or their entrances obstructed, to prevent their being used in this manner.

THE IRON ORES OF THE BRANDON PERIOD*

By Henry Carroll Lewis.

The theory that a great portion of the iron ores of our lower Silurian limestone valleys are of a tertiary age was first proposed by Prof. E. Hitchkock, but has been rejected by many geologists. The present paper describes in full recent discoveries, made by the writer, of lignite associated with limonite iron ores in the limestone valley of Montgomery County, Penn., and shows their relation to the deposit at Brandon, Vt., and their bearing upon a theory of the age of iron ores in similar positions in the Atlantic States. The lignite of Brandon, lying within beds of plastic clay, kaolin and iron ore, was shown by Lesquereaux to be of tertiary age. Lesley afterwards described strata of lignite in a similar position at Chambersburg, Penn., but regarded them as local deposits of late date. More recently Prime has found lignite in a plastic clay at Ironton, Penn., and supposed it to have been transported by a glacier. The present paper shows that in each of these cases the lignite lies far below the surface drift, and that, as at Brandon, the latter lies unconformably upon the plastic clays containing the lignite.

The occurrence of lignite in connection with limonite iron ore, plastic clay, kaolin and firesand in a number of places in Montgomery County, Penn., is described, and it is shown that these localities lie in a line corresponding to the line of strike of all the iron ores of the valley. Overlying the plastic clay which contains the lignite is what appears to be a decomposed lower Silurian hydromica slate, and for this reason the iron ores had been supposed to be of primal age. It is shown that this decomposed material and the underlying iron ores have been originally derived from lower Silurian slates, and have been re-stratified in an age intermediate between Triassic and Upper Tertiary.

The iron ores of this region may be divided into four classes: (1) Gneissic Ore; (2) Primal Ore; (3) Tertiary (Brandon) Ore; (4) Drift Ore. The last two classes of ore are often found at the same locality; the latter lying unconformably upon the former. The paper discusses at length the age of the drifts containing the latter. Notwithstanding the fact that a region of triassic red shale lies north and east of the valley, not a single fragment of such rock occurs in this drift. The pebbles are composed almost wholly of Potsdam sandstone,—a material now in great part eroded away in this vicinity. The evidence is strong that this drift was not caused by any flood from the north. That it is older than the Glacial Epoch is also shown both by the great amount of erosion it has suffered, and by the fact that in the adjoining triassic region no trace of drift occurs. It seems to have been formed at a time when hills of Potsdam sandstone, since eroded, stood as a barrrier between the limestone valley and the triassic rocks to the north. It is of interest to find that the pebbles of the sub-cretaceous clays of New Jersey are also formed of Potsdam. The four gravels of different ages of the Delaware valley are described, and it is shown that the drift ore of the Montgomery County valley belongs to the oldest of these, and is of Tertiary age.

It follows that the strata containing iron ore and lignite, which underlie unconformably to this drift, are yet older. Some facts point to a Wealden age, but the identity of the deposits with that at Brandon, in which Tertiary plants are found, indicates a middle Tertiary, perhaps *Oligocene* age. Since an exact geological age cannot at present be assigned to these deposits, it is thought best to group them together under the name of the *Brandon Period.*

* Read before the A. A. A. S., Boston, 1880.

Attention was directed to another deposit of lignite and iron ore near Augusta, Ga., recently found by N. A. Bibikov. Its geological situation and the section given is remarkably similar to those of Brandon, Chambersburg, Ironton and the Montgomery County Valley, and with them indicates the existence of a great inland fresh-water formation of Eastern America, during the Brandon Period, once fifty miles broad and nearly a thousand miles long.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

We have received the first publication of this Society, which was organized on the 7th of April last. The objects of this Society are to promote the Arts and Sciences connected with Engineering and Mechanical construction, by means of meetings for social intercourse and the reading and discussion of professional papers, and to circulate, by means of publications, the information thus obtained.

Mechanical, civil, military, mining, metallurgical and naval engineers and architects may be candidates for membership to this Society, the initiation fee of members and associates being $15 and their dues $10—payable in advance.

The first President is Professor Robert R. Thurston, of the Stevens Institute, Hoboken. The Society starts with two life members—Thomas A. Edison, of Menlo Park, and George H. Norman, of Boston, and 189 ordinary members of different grades. We wish this Society success, and shall chronicle the work it performs. Those who desire to become members should address Lycurgus B. Moore, 96 Fulton street, New York city.

PHYSICAL NOTES.

The beautiful proof that a constant current of electricity flowing through a thin gold plate can be deflected by a magnet, was exhibited by E. H. Hall on the 28th of last October, at Johns Hopkins University, and already we see how fruitful it is in suggestion to other scientists. Bolzmann, in a paper read before the Academy of Sciences in Vienna, calls attention to the fact that is possible to calculate the absolute velocity with which the electricity flows through the gold plate, and gives a formula.

A. von Ettinghausen also verifies Hall's observations and deductions, in a thorough article containing plates of original apparatus. (Carl's Reportorium, Vol. xvi., No. 9, p. 574.)

Dr. Hall himself, in the September number of *American Journal of Science*, gives another paper on the subject, with detail of additional experiments, in which, besides gold, he uses silver, platinum, iron, nickel and tin, as thin conductors. For further information on this most instructive and interesting subject references should be made to the above-mentioned articles.

It may be convenient to scientists who have had dealings with the late firm of Hall & Benjamin, of 191 Greenwich street, New York, one of the largest dealers in chemical and physical apparatus in this country, to know that J. & H. Berge, of 95 John Street, New York, have purchased everything appertaining to that business.

The old friends of Mr. Hall will be glad to learn that he remains in the business, and may be communicated with as before.

The catalogue of these united firms has been placed before us, and shows the magnitude of the business they conduct, and the great facilities they offer scientific men in the production of every kind of philosophical apparatus. This catalogue is a handsome volume of over 200 pages, illustrated throughout, and we advise chemists and physicists to apply for a copy.

in soft rock on the sides of hills—the apertures small and in some cases showing grooves for the adjustment of slabs of rock or other material to close them. The absence of remains in these caves could be explained from the fact that in earlier times outlaws and refugees often used them as places of shelter and residence, and laws had finally been passed by the governors of some of the districts causing the caves to be filled up, or their entrances obstructed, to prevent their being used in this manner.

THE IRON ORES OF THE BRANDON PERIOD*

By Henry Carroll Lewis.

The theory that a great portion of the iron ores of our lower Silurian limestone valleys are of a tertiary age was first proposed by Prof. E. Hitchkock, but has been rejected by many geologists. The present paper describes in full recent discoveries, made by the writer, of lignite associated with limonite iron ores in the limestone valley of Montgomery County, Penn., and shows their relation to the deposit at Brandon, Vt., and their bearing upon a theory of the age of iron ores in similar positions in the Atlantic States. The lignite of Brandon, lying within beds of plastic clay, kaolin and iron ore, was shown by Lesquereaux to be of tertiary age. Lesley afterwards described strata of lignite in a similar position at Chambersburg, Penn., but regarded them as local deposits of late date. More recently Prime has found lignite in a plastic clay at Ironton, Penn., and supposed it to have been transported by a glacier. The present paper shows that in each of these cases the lignite lies far below the surface drift, and that, as at Brandon, the latter lies unconformably upon the plastic clays containing the lignite.

The occurrence of lignite in connection with limonite iron ore, plastic clay, kaolin and firesand in a number of places in Montgomery County, Penn., is described, and it is shown that these localities lie in a line corresponding to the line of strike of all the iron ores of the valley. Overlying the plastic clay which contains the lignite is what appears to be a decomposed lower Silurian hydromica slate, and for this reason the iron ores had been supposed to be of primal age. It is shown that this decomposed material and the underlying iron ores have been originally derived from lower Silurian slates, and have been re-stratified in an age intermediate between Triassic and Upper Tertiary.

The iron ores of this region may be divided into four classes: (1) Gneissic Ore; (2) Primal Ore; (3) Tertiary (Brandon) Ore; (4) Drift Ore. The last two classes of ore are often found at the same locality; the latter lying unconformably upon the former. The paper discusses at length the age of the drifts containing the latter. Notwithstanding the fact that a region of triassic red shale lies north and east of the valley, not a single fragment of such rock occurs in this drift. The pebbles are composed almost wholly of Potsdam sandstone,—a material now in great part eroded away in this vicinity. The evidence is strong that this drift was not caused by any flood from the north. That it is older than the Glacial Epoch is also shown both by the great amount of erosion it has suffered, and by the fact that in the adjoining triassic region no trace of drift occurs. It seems to have been formed at a time when hills of Potsdam sandstone, since eroded, stood as a barrrier between the limestone valley and the triassic rocks to the north. It is of interest to find that the pebbles of the sub-cretaceous clays of New Jersey are also formed of Potsdam. The four gravels of different ages of the Delaware valley are described, and it is shown that the drift ore of the Montgomery County valley belongs to the oldest of these, and is of Tertiary age.

It follows that the strata containing iron ore and lignite, which underlie unconformably to this drift, are yet older. Some facts point to a Wealden age, but the identity of the deposits with that at Brandon, in which Tertiary plants are found, indicates a middle Tertiary, perhaps *Oligocene* age. Since an exact geological age cannot at present be assigned to these deposits, it is thought best to group them together under the name of the *Brandon Period.*

Attention was directed to another deposit of lignite and iron ore near Augusta, Ga., recently found by N. A. Bibikov. Its geological situation and the section given is remarkably similar to those of Brandon, Chambersburg, Ironton and the Montgomery County Valley, and with them indicates the existence of a great inland fresh-water formation of Eastern America, during the Brandon Period, once fifty miles broad and nearly a thousand miles long.

* Read before the A. A. A. S., Boston, 1880.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

We have received the first publication of this Society, which was organized on the 7th of April last. The objects of this Society are to promote the Arts and Sciences connected with Engineering and Mechanical construction, by means of meetings for social intercourse and the reading and discussion of professional papers, and to circulate, by means of publications, the information thus obtained.

Mechanical, civil, military, mining, metallurgical and naval engineers and architects may be candidates for membership to this Society, the initiation fee of members and associates being $15 and their dues $10—payable in advance.

The first President is Professor Robert R. Thurston, of the Stevens Institute, Hoboken. The Society starts with two life members—Thomas A. Edison, of Menlo Park, and George H. Norman, of Boston, and 189 ordinary members of different grades. We wish this Society success, and shall chronicle the work it performs. Those who desire to become members should address Lycurgus B. Moore, 96 Fulton street, New York city.

PHYSICAL NOTES.

The beautiful proof that a constant current of electricity flowing through a thin gold plate can be deflected by a magnet, was exhibited by E. H. Hall on the 28th of last October, at Johns Hopkins University, and already we see how fruitful it is in suggestion to other scientists. Bolzmann, in a paper read before the Academy of Sciences in Vienna, calls attention to the fact that is possible to calculate the absolute velocity with which the electricity flows through the gold plate, and gives a formula.

A. von Ettinghausen also verifies Hall's observations and deductions, in a thorough article containing plates of original apparatus. (Carl's Reportorium, Vol. xvi., No. 9, p. 574.)

Dr. Hall himself, in the September number of *American Journal of Science*, gives another paper on the subject, with detail of additional experiments, in which, besides gold, he uses silver, platinum, iron, nickel and tin, as thin conductors. For further information on this most instructive and interesting subject references should be made to the above-mentioned articles.

It may be convenient to scientists who have had dealings with the late firm of Hall & Benjamin, of 191 Greenwich street, New York, one of the largest dealers in chemical and physical apparatus in this country, to know that J. & H. Berge, of 95 John Street, New York, have purchased everything appertaining to that business.

The old friends of Mr. Hall will be glad to learn that he remains in the business, and may be communicated with as before.

The catalogue of these united firms has been placed before us, and shows the magnitude of the business they conduct, and the great facilities they offer scientific men in the production of every kind of philosophical apparatus. This catalogue is a handsome volume of over 200 pages, illustrated throughout, and we advise chemists and physicists to apply for a copy.

in soft rock on the sides of hills—the apertures small and in some cases showing grooves for the adjustment of slabs of rock or other material to close them. The absence of remains in these caves could be explained from the fact that in earlier times outlaws and refugees often used them as places of shelter and residence, and laws had finally been passed by the governors of some of the districts causing the caves to be filled up, or their entrances obstructed, to prevent their being used in this manner.

THE IRON ORES OF THE BRANDON PERIOD*

By Henry Carroll Lewis.

The theory that a great portion of the iron ores of our lower Silurian limestone valleys are of a tertiary age was first proposed by Prof. E. Hitchkock, but has been rejected by many geologists. The present paper describes in full recent discoveries, made by the writer, of lignite associated with limonite iron ores in the limestone valley of Montgomery County, Penn., and shows their relation to the deposit at Brandon, Vt., and their bearing upon a theory of the age of iron ores in similar positions in the Atlantic States. The lignite of Brandon, lying within beds of plastic clay, kaolin and iron ore, was shown by Lesquereaux to be of tertiary age. Lesley afterwards described strata of lignite in a similar position at Chambersburg, Penn., but regarded them as local deposits of late date. More recently Prime has found lignite in a plastic clay at Ironton, Penn., and supposed it to have been transported by a glacier. The present paper shows that in each of these cases the lignite lies far below the surface drift, and that, as at Brandon, the latter lies unconformably upon the plastic clays containing the lignite.

The occurrence of lignite in connection with limonite iron ore, plastic clay, kaolin and firesand in a number of places in Montgomery County, Penn., is described, and it is shown that these localities lie in a line corresponding to the line of strike of all the iron ores of the valley. Overlying the plastic clay which contains the lignite is what appears to be a decomposed lower Silurian hydromica slate, and for this reason the iron ores had been supposed to be of primal age. It is shown that this decomposed material and the underlying iron ores have been originally derived from lower Silurian slates, and have been re-stratified in an age intermediate between Triassic and Upper Tertiary.

The iron ores of this region may be divided into four classes: (1) Gneissic Ore; (2) Primal Ore; (3) Tertiary (Brandon) Ore; (4) Drift Ore. The last two classes of ore are often found at the same locality; the latter lying unconformably upon the former. The paper discusses at length the age of the drifts containing the latter. Notwithstanding the fact that a region of triassic red shale lies north and east of the valley, not a single fragment of such rock occurs in this drift. The pebbles are composed almost wholly of Potsdam sandstone,—a material now in great part eroded away in this vicinity. The evidence is strong that this drift was not caused by any flood from the north. That it is older than the Glacial Epoch is also shown both by the great amount of erosion it has suffered, and by the fact that in the adjoining triassic region no trace of drift occurs. It seems to have been formed at a time when hills of Potsdam sandstone, since eroded, stood as a barrrier between the limestone valley and the triassic rocks to the north. It is of interest to find that the pebbles of the sub-cretaceous clays of New Jersey are also formed of Potsdam. The four gravels of different ages of the Delaware valley are described, and it is shown that the drift ore of the Montgomery County valley belongs to the oldest of these, and is of Tertiary age.

It follows that the strata containing iron ore and lignite, which underlie unconformably to this drift, are yet older. Some facts point to a Wealden age, but the identity of the deposits with that at Brandon, in which Tertiary plants are found, indicates a middle Tertiary, perhaps *Oligocene* age. Since an exact geological age cannot at present be assigned to these deposits, it is thought best to group them together under the name of the *Brandon Period.*

Attention was directed to another deposit of lignite and iron ore near Augusta, Ga., recently found by N. A. Bibikov. Its geological situation and the section given is remarkably similar to those of Brandon, Chambersburg, Ironton and the Montgomery County Valley, and with them indicates the existence of a great inland fresh-water formation of Eastern America, during the Brandon Period, once fifty miles broad and nearly a thousand miles long.

* Read before the A. A. A. S., Boston, 1880.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

We have received the first publication of this Society, which was organized on the 7th of April last. The objects of this Society are to promote the Arts and Sciences connected with Engineering and Mechanical construction, by means of meetings for social intercourse and the reading and discussion of professional papers, and to circulate, by means of publications, the information thus obtained.

Mechanical, civil, military, mining, metallurgical and naval engineers and architects may be candidates for membership to this Society, the initiation fee of members and associates being $15 and their dues $10—payable in advance.

The first President is Professor Robert R. Thurston, of the Stevens Institute, Hoboken. The Society starts with two life members—Thomas A. Edison, of Menlo Park, and George H. Norman, of Boston, and 189 ordinary members of different grades. We wish this Society success, and shall chronicle the work it performs. Those who desire to become members should address Lycurgus B. Moore, 96 Fulton street, New York city.

PHYSICAL NOTES.

The beautiful proof that a constant current of electricity flowing through a thin gold plate can be deflected by a magnet, was exhibited by E. H. Hall on the 28th of last October, at Johns Hopkins University, and already we see how fruitful it is in suggestion to other scientists. Bolzmann, in a paper read before the Academy of Sciences in Vienna, calls attention to the fact that is possible to calculate the absolute velocity with which the electricity flows through the gold plate, and gives a formula.

A. von Ettinghausen also verifies Hall's observations and deductions, in a thorough article containing plates of original apparatus. (Carl's Reportorium, Vol. xvi., No. 9, p. 574.)

Dr. Hall himself, in the September number of *American Journal of Science*, gives another paper on the subject, with detail of additional experiments, in which, besides gold, he uses silver, platinum, iron, nickel and tin, as thin conductors. For further information on this most instructive and interesting subject references should be made to the above-mentioned articles.

It may be convenient to scientists who have had dealings with the late firm of Hall & Benjamin, of 191 Greenwich street, New York, one of the largest dealers in chemical and physical apparatus in this country, to know that J. & H. Berge, of 95 John Street, New York, have purchased everything appertaining to that business.

The old friends of Mr. Hall will be glad to learn that he remains in the business, and may be communicated with as before.

The catalogue of these united firms has been placed before us, and shows the magnitude of the business they conduct, and the great facilities they offer scientific men in the production of every kind of philosophical apparatus. This catalogue is a handsome volume of over 200 pages, illustrated throughout, and we advise chemists and physicists to apply for a copy.

in soft rock on the sides of hills—the apertures small and in some cases showing grooves for the adjustment of slabs of rock or other material to close them. The absence of remains in these caves could be explained from the fact that in earlier times outlaws and refugees often used them as places of shelter and residence, and laws had finally been passed by the governors of some of the districts causing the caves to be filled up, or their entrances obstructed, to prevent their being used in this manner.

THE IRON ORES OF THE BRANDON PERIOD*

By Henry Carroll Lewis.

The theory that a great portion of the iron ores of our lower Silurian limestone valleys are of a tertiary age was first proposed by Prof. E. Hitchkock, but has been rejected by many geologists. The present paper describes in full recent discoveries, made by the writer, of lignite associated with limonite iron ores in the limestone valley of Montgomery County, Penn., and shows their relation to the deposit at Brandon, Vt., and their bearing upon a theory of the age of iron ores in similar positions in the Atlantic States. The lignite of Brandon, lying within beds of plastic clay, kaolin and iron ore, was shown by Lesquereaux to be of tertiary age. Lesley afterwards described strata of lignite in a similar position at Chambersburg, Penn., but regarded them as local deposits of late date. More recently Prime has found lignite in a plastic clay at Ironton, Penn., and supposed it to have been transported by a glacier. The present paper shows that in each of these cases the lignite lies far below the surface drift, and that, as at Brandon, the latter lies unconformably upon the plastic clays containing the lignite.

The occurrence of lignite in connection with limonite iron ore, plastic clay, kaolin and firesand in a number of places in Montgomery County, Penn., is described, and it is shown that these localities lie in a line corresponding to the line of strike of all the iron ores of the valley. Overlying the plastic clay which contains the lignite is what appears to be a decomposed lower Silurian hydromica slate, and for this reason the iron ores had been supposed to be of primal age. It is shown that this decomposed material and the underlying iron ores have been originally derived from lower Silurian slates, and have been re-stratified in an age intermediate between Triassic and Upper Tertiary.

The iron ores of this region may be divided into four classes: (1) Gneissic Ore; (2) Primal Ore; (3) Tertiary (Brandon) Ore; (4) Drift Ore. The last two classes of ore are often found at the same locality; the latter lying unconformably upon the former. The paper discusses at length the age of the drifts containing the latter. Notwithstanding the fact that a region of triassic red shale lies north and east of the valley, not a single fragment of such rock occurs in this drift. The pebbles are composed almost wholly of Potsdam sandstone,—a material now in great part eroded away in this vicinity. The evidence is strong that this drift was not caused by any flood from the north. That it is older than the Glacial Epoch is also shown both by the great amount of erosion it has suffered, and by the fact that in the adjoining triassic region no trace of drift occurs. It seems to have been formed at a time when hills of Potsdam sandstone, since eroded, stood as a barrrier between the limestone valley and the triassic rocks to the north. It is of interest to find that the pebbles of the sub-cretaceous clays of New Jersey are also formed of Potsdam. The four gravels of different ages of the Delaware valley are described, and it is shown that the drift ore of the Montgomery County valley belongs to the oldest of these, and is of Tertiary age.

It follows that the strata containing iron ore and lignite, which underlie unconformably to this drift, are yet older. Some facts point to a Wealden age, but the identity of the deposits with that at Brandon, in which Tertiary plants are found, indicates a middle Tertiary, perhaps *Oligocene* age. Since an exact geological age cannot at present be assigned to these deposits, it is thought best to group them together under the name of the *Brandon Period.*

* Read before the A. A. A. S., Boston, 1880.

Attention was directed to another deposit of lignite and iron ore near Augusta, Ga., recently found by N. A. Bibikov. Its geological situation and the section given is remarkably similar to those of Brandon, Chambersburg, Ironton and the Montgomery County Valley, and with them indicates the existence of a great inland fresh-water formation of Eastern America, during the Brandon Period, once fifty miles broad and nearly a thousand miles long.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

We have received the first publication of this Society, which was organized on the 7th of April last. The objects of this Society are to promote the Arts and Sciences connected with Engineering and Mechanical construction, by means of meetings for social intercourse and the reading and discussion of professional papers, and to circulate, by means of publications, the information thus obtained.

Mechanical, civil, military, mining, metallurgical and naval engineers and architects may be candidates for membership to this Society, the initiation fee of members and associates being $15 and their dues $10—payable in advance.

The first President is Professor Robert R. Thurston, of the Stevens Institute, Hoboken. The Society starts with two life members—Thomas A. Edison, of Menlo Park, and George H. Norman, of Boston, and 189 ordinary members of different grades. We wish this Society success, and shall chronicle the work it performs. Those who desire to become members should address Lycurgus B. Moore, 96 Fulton street, New York city.

PHYSICAL NOTES.

The beautiful proof that a constant current of electricity flowing through a thin gold plate can be deflected by a magnet, was exhibited by E. H. Hall on the 28th of last October, at Johns Hopkins University, and already we see how fruitful it is in suggestion to other scientists. Bolzmann, in a paper read before the Academy of Sciences in Vienna, calls attention to the fact that is possible to calculate the absolute velocity with which the electricity flows through the gold plate, and gives a formula.

A. von Ettinghausen also verifies Hall's observations and deductions, in a thorough article containing plates of original apparatus. (Carl's Reportorium, Vol. xvi., No. 9, p. 574.)

Dr. Hall himself, in the September number of *American Journal of Science*, gives another paper on the subject, with detail of additional experiments, in which, besides gold, he uses silver, platinum, iron, nickel and tin, as thin conductors. For further information on this most instructive and interesting subject references should be made to the above-mentioned articles.